SCIENTIFIC AMERICAN

Entered at the Post Office of New York, N. Y., as Second Class matter. Copyrighted, 1893, by Munn & Co.

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. LXVIII.—No. 23.
ESTABLISHED 1845.

NEW YORK, JUNE 10, 1893.

$3.00 A YEAR.
WEEKLY.

TRAVELING CRANES AT THE BROOKLYN NAVY YARD.

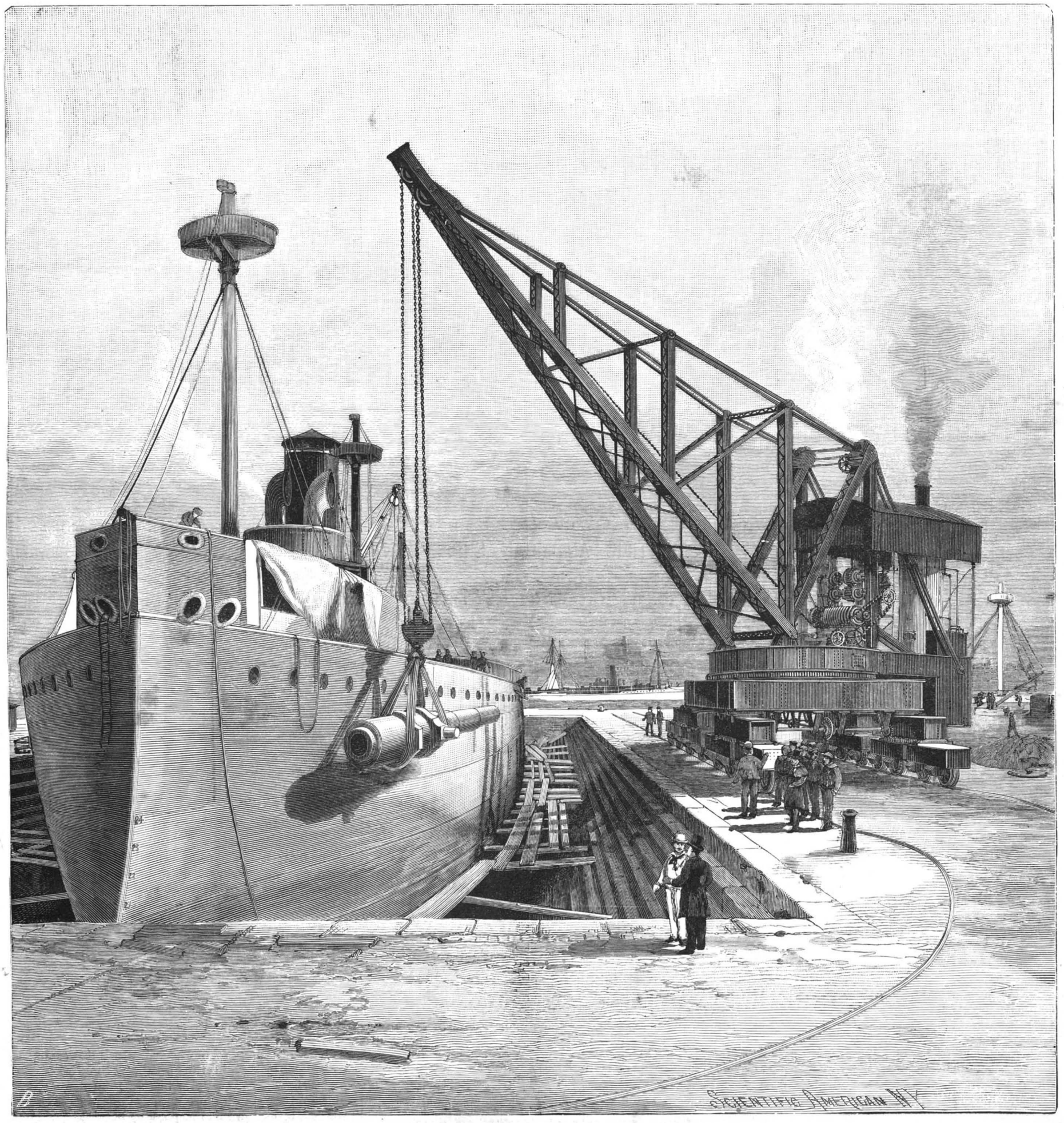
Among the improvements recently adopted by the Navy department for handling the heavy armor plates and guns for our new navy are the new traveling cranes illustrated in this issue, being the greatest advance in navy yard appliances made since the building of the present dry docks, each of the Brooklyn dry docks now having one of the largest traveling power cranes in the world.

They are of the capacity of 40 tons at a distance of 56 feet from their centers. At the old stone dock, this distance nearly covers the entire vessel. At the new dock, it covers the sides and gun carriages.

Our illustration represents the new armored cruiser Maine in the dock, and the crane handling a 10 inch gun. The placing of the protective armor will be done while the vessel is in the dry dock, the plates of which, weighing from 25 to 30 tons each, will be handled by the new crane.

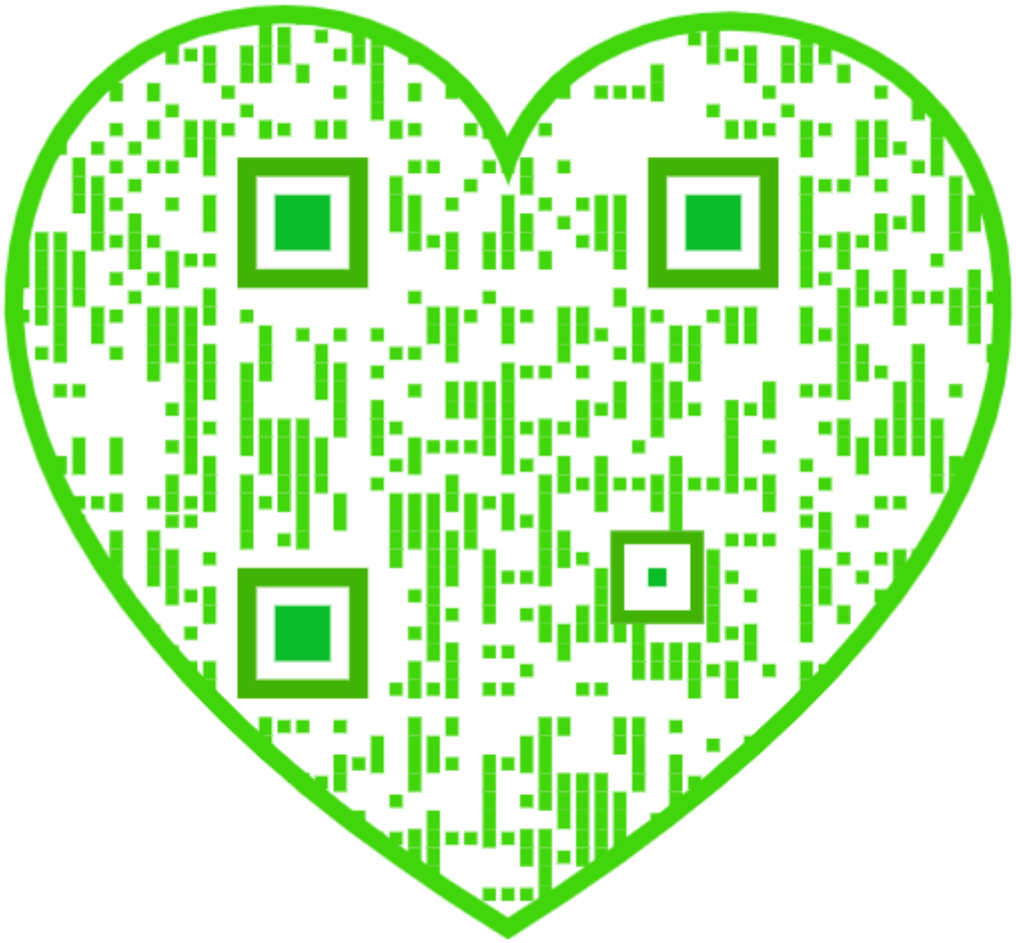
It is of the balanced type, running on an 18 feet gauge track on the sides and around the head of the dock. It is a massive structure resting upon 16 wheels, double flanged, in 8 track trucks of 2 wheels each, swiveled; each pair of track trucks is connected by a swiveling beam under the main frame. Two of the wheels in each combination truck, or 8 in all, are driving wheels geared through a compensating gear train with the main engine, to enable the crane to be moved on the short curve around the head of the dock without strain or undue friction.

The power for all work is derived from a pair of engines with cylinders 10 inches by 12 inches, geared to an iron grooved drum 30 inches diameter, 8 feet long. Shifting clutches operated by levers on the floor of the frame are the devices for transferring the



THE NEW TRAVELING CRANES AT THE BROOKLYN NAVY YARD.

© 1893 SCIENTIFIC AMERICAN, INC.



power between hoisting, swinging and truck motion with a lever and link to control the speed in the engine. These are placed at a commanding position on the floor of the frame.

The lift is three part, using a 1½ inch chain.

The boiler is vertical, of 75 h. p., carrying 100 lb. steam pressure, placed over the counterweight, which is ballasted with 75 tons of iron. The total weight of each crane is 192 tons.

They were built by Wm. Sellers & Co., Philadelphia.

Improvements in the Manufacture of Dyestuffs.

BLACKISH BLUE AZO DYE.

This new dyestuff is derived from equal molecular proportions of diazotized dianisidin, the sodium salt of mono-sulpho-dioxy-naphthoic acid, and (1·4) alpha-naphthol alphamono-sulphonic acid of Nevile & Winther, and which is a grayish black glittering powder of a metallic luster, easily soluble in water with a blackish blue, in concentrated sulphuric acid with a green-blue coloration; difficultly soluble in alcohol and insoluble in ether and benzine.

IMPROVED DYE FROM ALPHA OXYUVITIC ACID.

The improvement consists in the new process of manufacturing of meta-azo compounds serving as coloring matêrs, said process consisting in combining alpha oxyuvitic acid with diazo compounds.

GRAY BLACK TETRAZO DYE.

This dyestuff is produced in combining one molecular proportion of tetrazo-diphenyl or ditolyl with two molecular proportions of the sodium salt of mono-sulpho-dioxy-naphthoic acid, and which is a dark glittering crystalline powder of metallic luster, which dissolves easily in water with a red-violet, in concentrated sulphuric acid with a pure blue coloration, and is insoluble in alcohol, ether, and benzine.

NEW PINK DYE.

This is a new article of coloring matter, manufactured from the alkali salt of a sulphonic acid derived from fluorescein chloride and mesidine, and having the formula $C_{38}H_{33}O_3N_2So_2$ alk.; a light red powder easily soluble in hot and cold water, difficultly soluble in alcohol, giving vivid red color, mineral acids precipitating from its aqueous solution, the sulphonic acid in the form of red flakes.

A NEW RED DYESTUFF.

This new red azo dye coloring matter is derived from diazotized mono-nitro-benzidine, salicylic, and alpha-naphthol-alpha-mono-sulpho-acid (Nevile & Winther), and which is a red brown powder difficultly soluble in cold water and alcohol, insoluble in benzine, but readily soluble in warm water, with a yellow-red color.—*Textile Record.*

Silver Mining.

The president of the Huanchaca Mining Company, of Bolivia, was recently reported as saying that he expected that silver would still further decrease in value, but that such decrease would have no effect on the Huanchaca Company, because it could produce silver at a profit even if the price dropped to 270 francs per kilo, or say 42 cents per ounce. This is by no means an idle boast. During 1891, this company mined 5,497,963 ounces of silver at a total cost of $2,414,360, or 44 cents per ounce. This cost in detail as follows: Mining, 16 cents; new works, 6 cents; reduction and smelting, 9 cents; taxes and export dues, 5 cents; general expenses, 8 cents. Notwithstanding the low price of silver during the past year, the output of this mine increased nearly 15 per cent, amounting to 6,667,703 ounces, and the ore reserves are larger than before. For the 15 years ending with 1891, this company produced bullion valued at $43,033,899, paid $14,168,038 in dividends, and has set aside a reserve fund of $1,776,765.

This mine by no means stands alone as regards cheapness of working, although it stands second among the silver mines of the world in point of output. Thus the Broken Hill Proprietary Company, of Australia, the greatest silver mine in the world, produced in six years and a half ending May 30, 1892, a total of 36,512,445 ounces of silver and 152,000 tons of lead, at a total cost of $21,356,235. The cost per ounce of silver varied from 66 cents in 1887 to 41 cents in 1890, the average being 47 cents; the cost per pound of lead varied from 2·3 cents in 1887 to 1·4 in 1892, the average being 1·65 cents. This company has paid dividends amounting to $19,480,000.

In the United States the Ontario Mining Company has, since 1880, produced 26,261,076 ounces of silver at a total cost of $14,771,862, an average of 55 cents per ounce. The Granite Mountain Mining Company has, since 1883, produced 21,430,000 ounces, at a total cost of $8,376,620, an average of 39 cents per ounce. Some of these mines are becoming exhausted, notably the Granite Mountain, but new ones are constantly being discovered, and in all probability will continue to be discovered for many years to come. Thus the recently discovered Creede district produced 5,000,000 ounces in 1892, of which it is said that the greater part was produced at an average cost of less than 40 cents per ounce.—*Eng. and Min. Jour.*

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico.....$3 00
One copy, six months, for the U. S., Canada or Mexico..... 1 50
One copy, one year, to any foreign country belonging to Postal Union. 4 00

Remit by postal or express money order, or by bank draft or check. MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

is a distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT is issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, $5.00 a year, for the U. S., Canada or Mexico. $6.00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page.

Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of *seven dollars*. To foreign countries within Postal Union, *eight dollars and fifty cents a year.*

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world.

Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, $2.50 a year. To foreign Postal Union countries, $3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, $5.00 a year. To foreign Postal Union countries, $6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, $9.00 a year. To foreign Postal Union countries, $11.00 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is profusely illustrated. It is the finest scientific, industrial trade paper printed in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. $3.00 a year, post paid to any part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers,
361 Broadway, New York.

☞ The safest way to remit is by postal order, express money order, draft or bank check. Make all remittances payable to order of MUNN & CO.

☞ Readers are specially requested to notify the publishers in case of any failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, JUNE 10, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

Agricultural inventions, recent.. 363
Air, foul, removing from a well. 356
Arctic regions, life in the..... 359
Barge, pleasure, for an Indian prince..... 356
Books and publications, new.... 363
Brass coloring..... 354
Brass, dip for (5123)..... 364
Carriage indicator, Blake's*..... 361
Coal and ore drier and separator, Tench's*..... 356
Commercial National Bank, Chicago..... 354
Cornell University, a $50,000 gift to..... 355
Cotton picker, pneumatic, Maurermann's*..... 361
Cranes, large, Brooklyn navy yard*..... 353
Diamonds at the World's Fair... 361
Drowning, methods of rescue from*..... 360
Dyestuffs, manufacture of..... 354
Earthenware ignition tubes..... 360
Electricity, tanning by..... 357
Electric railway conduit, Moffett's*..... 356
Electric tramway propulsion by accumulators..... 358
Elms, the Twin..... 356
Engineering in Mexico..... 362
Etaings iron works, the, France* 361
Exhibit, life saving..... 355
Exploration, African..... 355
Exposition, Columbian, electricity at..... 357
Exposition, Columbian, statue of La France at..... 358
Exposition notes..... 355
Feathers and lightning..... 359
Fire jets..... 359
Flour mill, largest in the world.. 359
Heat concentration by a lens (5128)..... 364
Inventions, recently patented... 363
Japan, family relations in..... 361
Jupiter and his satellites..... 359
Mangle, the Hagen*..... 357
Patents granted, weekly record. 365
Perfumes of flowers, localizing.. 357
Photography at Exposition..... 354
Photography of the phonograph 360
Photography on marble..... 357
Pocket, Diefenbach's safety*.... 357
Railway appliances, some new... 363
Silver mining..... 354
Stars of the Milky Way..... 359
Steam hammer, 100 ton, and large rolling mill*..... 361
Submarine blasting..... 356
Telegraph decision, a..... 358
Thermometric systems, the..... 358
Wood, insect-infested (5120)..... 364
Wrench, Wells'*..... 357

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT

No. 910.

For the Week Ending June 10, 1893.

Price 10 cents. For sale by all newsdealers.

PAGE

I. AGRICULTURE.—The Loss of Nitrogen in Manures.—By A. MUNTZ and A. CH. GIRARD.—A great source of deterioration in natural manures.—The inefficacy of copperas and gypsum in preventing it, and the simpler methods available for the farmer..... 14550

II. ANTHROPOLOGY.—Among the Cliff Dwellers.—By CLEMENT L. WEBSTER.—A most interesting discovery.—A mummy of a child of the Cliff Dwellers.—Description of the locality where the mummy was found and of the mummy itself.—2 illustrations..... 14549

III. ASTRONOMY.—Novel Theory of the Moon's Surface.—A theory of the formation of the mountains and other superficial irregularities upon the moon.—The probability of the impact upon the moon's surface of smaller bodies..... 14550

IV. COLUMBIAN EXPOSITION.—The World's Columbian Exposition.—A very valuable and timely paper on this subject, giving the views of different foreign journals upon the Fair, with numerous illustrations of the buildings, rounds, and personnel, showing the favorable impression the great American Exhibition has produced upon different authorities abroad.—32 illustrations..... 14536

V. ELECTRICITY.—The Telectroscope.—By LEON LE PONTOIS.—A suggestion for the electrical transmission of vision.—Seeing at a distance by means of electricity.—A suggestive and interesting paper.—3 illustrations..... 14546

VI. MECHANICAL ENGINEERING.—Improvements in Tool Holders and Cutting Tools.—A very ingenious tool for use on the lathe.—The use of circular eccentrically pivoted cutters adjustable by a set screw in the end of the tool bar.—5 illustrations..... 14547

VII. MINING ENGINEERING.—The New Hydrogen Miner's Safety Lamp.—By Prof. F. CLOWES.—A miner's lamp capable of supplying at once the ordinary illuminating flame, and when desired a hydrogen flame for testing by means of the "flame cap" for the presence of explosive gas..... 14544

VIII. ORNITHOLOGY.—The Cockatoos.—An interesting family of the parrot order.—A full description of their habitat.—Their habits of life and other interesting particulars with reference especially to the cockatoos in the Paris Garden of Plants.—1 illustration..... 14548

IX. TECHNOLOGY.—Skim Milk for Manufacturing Purposes.—By J. CARTER BELL.—The curious utilization of skim milk for making artificial bone or ebony and similar substances, as proposed to be carried out in England.—An American patent for similar purposes..... 14545

X. VITICULTURE.—The Use of Poisons as Fungicides and Insecticides.—By L. R. TAFT.—The use of sulphate of copper and other poisonous substances for making spray mixtures for vines and fruit.—The necessity of care in the application of such poisons, with minimum strength required to do efficacious work..... 14549

THE COMMERCIAL NATIONAL BANK OF CHICAGO.

In our issue of May 27, 1893, alluding to the reported failure of the bank established in the Administration building, our correspondent in Chicago inadvertently gave the name as the Commercial National Bank of Chicago, whereas the real delinquent was the Chemical National Bank of that city. Those who are at all acquainted with the monetary affairs of Chicago must have observed the error at once. The Commercial National Bank is well known as one of the safest and most reliable banking institutions in the country, while its officers and directors are distinguished for their sterling integrity and business ability. Such a calamity as the failure of the institution, at the present time, in the height of its prosperity, is out of the question. We greatly regret that the error should have crept into our columns.

PHOTOGRAPHY AT THE WORLD'S COLUMBIAN EXPOSITION.

It is an easy matter for people inclined in this direction to find fault, and in such an enormous undertaking as the World's Columbian Exposition there are naturally many things to which exceptions can be taken. But the Exposition is such a grand success, as a whole, and it has been carried out on such a broad plan that fault finding in most instances can only be of a dyspeptic sort. There is one matter, however, that has been allowed to drag which should have been taken up long ago, and which should, even now at this late day, be discussed in such a manner as to bring the attention of the Exposition management to it and lead to reform. We refer to photography in connection with the Exposition.

At the time of the Centennial Exposition dry plates were just coming into use and amateur photography was beginning to be popular. During these intervening years there have been no startling or radical changes in photography, but amateurs have become so skilled, and in many instances have produced such perfect specimens of work, that public taste has been educated up to a point where it accepts only good photographs—pictures in which the subject is well chosen and which also are well developed and printed with care and judgment. So much progress has been made in this direction since the Centennial that people naturally expect to find on sale at the Columbian Exposition photographs that the photographic fraternities would feel proud of. There never has been opportunity for such a harvest of fine pictures as this exposition affords. It has a large amount of ornamental statuary that is acknowledged to be thoroughly artistic and beautiful. Its buildings are infinitely finer in design than anything ever seen in the new world. The grounds in which the Exposition is located are a masterpiece in landscape gardening. Many people of this country as well as many Europeans who have traveled extensively are astonished at the conception of the Exposition and at the beauty to be found in Jackson Park.

Yet, in spite of all these things, it is not possible to procure thoroughly good official photographs at the World's Columbian Exposition. The workmanship is in no respect better than was to be found at the Centennial. In fact, it is not as good, considering the fact that so many years have intervened and that so many improved processes have since been introduced. The subjects are selected with a lack of judgment and taste, and the developing is of ordinary quality. An exhibition by amateur photographers in any part of the country, judging by the samples that have been seen by members of photographic societies, could show specimens of work superior to the pictures offered for sale at the World's Columbian Exposition. The photographic department is such an appalling failure from the standpoint of the photographer, whether he be amateur or professional, that some public protest should be made against this condition of things before it is too late to have the necessary photographs taken to preserve some of the beauties of the Exposition.

Brass Coloring.

A fine black color, which can be varied to a light brown, can be produced on brass by treatment with an ammoniacal copper solution made by dissolving one part of copper nitrate in two parts of ammonia of specific gravity 0·96 while keeping the solution cool. The brass articles, which must be carefully cleaned, acquire a light tone on first being immersed, but on exposure for some hours become deep black. The treatment can be interrupted when the desired tint is reached. A luster can be put on the articles by rubbing with a little wax or vaseline. The process can be varied and other color effects obtained by treatment of the article after the development of the black color with very dilute hydrochloric acid, which dissolves the coating gradually and thus modifies the tint. The composition of the brass also has an influence on the result, and the coloring produced recalls that seen on Japanese bronze, which has possibly been obtained by a similar method.

© 1893 SCIENTIFIC AMERICAN, INC.

During the month of May many sensational newspaper reports were published regarding a lack of harmony in the management of the World's Columbian Exposition. Judging by many inquiries that have been received in Chicago, it would seem as though many people who contemplated visiting the Exposition had become imbued with the idea that the Exposition had been much neglected in order that these official differences might receive all public attention. A great deal more is known in the outside world about these differences than is heard in Chicago; in fact, they attract no attention in Chicago, being entirely overshadowed by the magnificence of the Exposition. If any troubles exist they are, doubtless, due to the complicated nature of the management. It has been quite impossible from the first to know where authority rested and to whom officials were responsible. The national commission has felt that it was final authority, as it represented the government; but the directors have considered that they should have final say, because of the fact that they represent the corporation which put up the greater part of the money to pay the bills of the Exposition.

By far the most attractive feature, of late, at the Exposition, has been the evening sessions, when the grounds and buildings were illuminated. The full scheme of illumination has not been carried out, although it has been promised on one or two occasions, and had it not been for these promises the illuminating as given would have been more than satisfactory. The Basin forms a center around which all the illuminating is done, although many people seem to have been taken with the idea that the whole grounds would be illuminated on the same plan. The cornices of all the buildings facing the Basin are outlined with incandescent lamps, and the nosing of the walls forming the side of the Basin and adjoining waterways is also outlined with these lamps. The great Columbus arch in the Peristyle is made brilliant with red lights, while at the opposite end of the Basin stands the Administration building, which is a mass of illumination with lights on the cornices and on the ribs of the dome. On the colonnade story are torches on each of the four faces, which add much to the effect with their flare and flicker. Owing to a mistake in the arrangements of the electrical fountains, it has not been possible, as yet, to use them. This is not because of any fault in the electrical equipment, but to a mistake in the hydraulic arrangement. Every evening that the Exposition has been open the attendance has been much larger than during any day with the exception of the opening day on May 1.

Several attractive features of the Exposition were much delayed in opening to the public. The Streets of Cairo, the Irish Village, and other attractions in Midway Plaisance did not open to the public until the last week in May, while inside the Exposition grounds some of the German, also the French, Italian and other exhibits, were delayed in opening. The Electrical building was not formally opened to the public until the first of June, although visitors had had free access to the building, and were permitted to see it in its unfinished state.

A corps of official guides has been provided to pilot visitors about the Exposition grounds. The grounds are so immense and there are so many buildings that it is bewildering to visitors who are not thoroughly posted to find their way about. One difficulty that has been experienced all along has been the fact that the Columbian guards have known nothing about the several buildings in the grounds, so that as guides they have been useless, and visitors who have not learned to make their way about have found it impossible to locate some of the most attractive exhibits without loss of time. The guides are intended to be thoroughly posted, not only upon the general plan of the grounds, but also upon matters pertaining to the exhibits, so that they may be of practical use to visitors who wish to make a study in any direction or in any particular line of exhibits.

The last Sunday in May will be a memorable one in the history of the Exposition, as it was the first Sunday upon which the grounds were thrown open to the public. If the question of Sunday opening had been one for the local directory to pass final judgment upon, the grounds would have been open every Sunday. The question was not sufficiently settled until the 24th day of the month, when the national commission, which was the last body to consider the question, voted for Sunday opening. The result proved in every way all that had been hoped for by the friends of Sunday opening. The attendance was the largest of any day up to that date with the exception of the opening day on May 1st. It was not until about one o'clock that there was any semblance to a crowd inside the gates. During the early part of the day, when church services were being held, the grounds were practically deserted, but by one o'clock visitors were pouring in from all directions, and before night at least one hundred thousand people had paid admission, to say nothing of the number of passes that were used. The people seemed to comprise very largely those who were not able to visit the grounds during the week. Family parties were in the majority, and a large portion of the people carried lunch, with the evident purpose of reaping the full benefit of the long day, as the Exposition was open until eleven o'clock in the evening. One of the interesting sights of the day was to see the many nationalities represented. Thousands of Germans visited the German village in Midway Plaisance, the German government building, and the several German exhibits. Swedes and Norwegians seemed to visit their respective buildings and exhibits, and many Irishmen visited the two Irish concessions. Chinamen were in abundance in the Chinese theater. The main center of attraction, judging by the size of the crowd, was the Midway Plaisance, which was jammed with people from early in the afternoon until nearly eleven o'clock in the evening. The bazars were all opened to the public, and did a large business.

In the main Exposition grounds the Government building was closed, and no machinery was running in the Palace of Mechanic Arts. Many of the State buildings were open, as were also foreign government buildings. The Gallery of Fine Arts was very popular and was densely crowded. The Manufactures and Liberal Arts building was nearly as popular as the Gallery of Fine Arts. Most of the exhibits were thrown open. A few, however, were closed. The illumination in the evening was the first one that many of the visitors had seen, and was more fully appreciated probably than any illumination that had been held since the Exposition was opened. A large part of the power plant was required to be in operation because of the illumination, and visitors thronged Machinery Hall, watching the great electrical engines. The day was beautiful and the crowd was orderly in every respect, there being less trouble than there had been on most week days during the month. Just outside of the grounds saloons and fakir shows in great variety were in full operation and used every effort to attract the crowd, but business, to use the expression of the managers of the fakir shows, was "bum." On previous Sundays thousands of people had haunted these shows and saloons, and the lawlessness and drunkenness resulting was quite appalling.

The Midway Plaisance is one of the features of the Exposition that has not been appreciated by early visitors at the Exposition. Many people have not even taken the trouble to investigate to see what its attractions are. It is a part of the Exposition, so far as the admission is concerned. The SCIENTIFIC AMERICAN of May 27 contained a full list of the more important of the concessions, but no idea of the real interest there is in many of them can be conveyed in words. Certain it is that visitors who neglect to see what there is in the Midway Plaisance make a mistake.

Much fine music has been rendered at the Exposition, but has not been fully appreciated by the public, although the band concerts in the open air have been well attended. Music Hall has been used almost daily since the Exposition was opened, but because of the comparatively small attendance at the Exposition, and probably because of the chilly weather, the attendance has been small. In addition to concerts, in which an admission is charged, free concerts are given each day in this hall at noon. These concerts are orchestral. Band concerts are given daily in the open air from the band stands in front of the Administration building. The more important musical gatherings are held in Festival Hall. This building was erected for this special purpose, and was formally opened on May 22 with a Wagner's programme, the day being the anniversary of the great composer's birth. The best week of music was that held during the last week in May. The special feature for the week included three chamber concerts, two oratorio performances and three symphony concerts in addition to the regular daily programme.

The Public Press Congress, the second of the series in connection with the World's Congress Auxiliary of the Exposition, opened on Monday, May 22, and continued for a week with several meetings every day. Representatives were present from nearly every nation in the world. Woman's work in the newspaper world received its full share of attention, and all lines of journalism were discussed, including trade journalism, the religious press, etc. Many interesting papers were read by well known newspaper workers and much attention was shown those in attendance at the congress both in the city and at the Exposition. Resolutions were unanimously passed pronouncing the charges of extortions in the city of Chicago as unfounded; declaring that the "public can attend the world's greatest Exposition at a reasonable cost;" and calling upon the press of the country to make known the rights of the people for cheaper rates to the Exposition.

African Exploration.

M. Delcommune, who, with his surviving companions, has just arrived in Belgium, has issued a summary of his discoveries. The London *Times* says they complete those of Livingstone, Cameron, and Stanley to the north, and of Reichardt, Capello, and Ivens to the south, comprising as they do the sources of the Congo and the course of its principal affluents.

The Congo issues from a chain of mountains, which extends from the shores of the southern extremity of the Tanganyika Lake to the extreme north of the Nyassa. It forms in those countries a river called the Tchambesi, discovered in the course of the last century by a Portuguese traveler, Lacerda, and forms the chief affluent of Lake Banguelo. The waters of the Banguelo descend from a height of 1,100 meters into Lake Moero, 900 meters above the level of the sea, by means of the River Luapala, 300 kilometers long, which is a succession of rapids. The Moero constitutes a second reservoir, and sends forth a stream 800 meters broad, which reaches the village of Ankorro by a series of waterfalls. At this point it becomes navigable, receiving upon its western bank the Lualaba, also navigable, whose waters have been swollen in their turn by the Lunga and the Lovoi on the western, the Lufira on the eastern bank, and by the discharge of the Lakes Kabele, Upemba, and Kassali.

Between the 8th and 9th degrees of latitude, the Congo receives on the right the Lukuga, which draws off the overflow of Lake Tanganyika, as described by Cameron and Stanley. M. Delcommune confirms the assertions of these explorers, that the Lukuga is an unimportant waterway, as its course is obstructed and only flows freely when the waters of the Tanganyika are exceptionally high. The Luapala, on the contrary, empties Lake Banguelo, which was formerly an inland sea, but is now bordered by vast swamps. When the Congo finally reaches Nyangwe it measures some 1,200 meters from bank to bank. Lake Landji, though marked on the maps according to the reports of the Arabs, has no existence.

M. Delcommune left Albertville, on the Tanganyika, on September 29, and arrived at Lusambo on January 7, after M. Dhanis' victory. He was rejoined at Lusambo by the Bia expedition. The country which he traversed with his caravan of 112 persons is good. He did not suffer from famine, as in the south, nor did any Arabs cross his path.

A telegram has been received from Boma by the Congo companies, reporting the death of M. Van den Kerckhoven, the leader of the Lado expedition.

Letters from the son of Tippoo Tib confirm the report of the death of Emin Pasha, who is represented to have been killed fighting, as well as all his people.

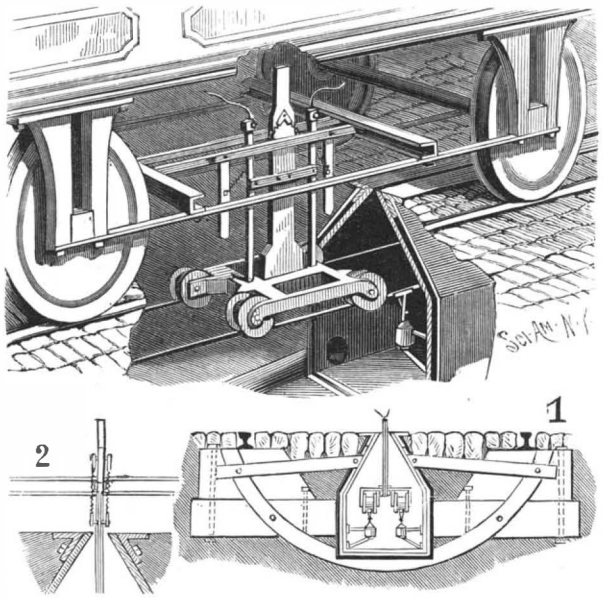
A Life Saving Exhibit at the Fair.

Besides the exhibits of all the latest life-saving apparatus contained in the new station at the world's fair, there are several exhibits of older appliances which have interesting histories. Among them is the first life car ever used on the coast of the United States, and with it the mortar and ball which are the neccessary adjuncts to such work. With this apparatus, in 1850, a life-saving crew on Squan beach, New Jersey, saved 250 lives from the wrecked British ship Ayrshire. The passengers were mostly Irish immigrants, some of whom settled in the immediate neighborhood, and it was from them that Lieutenant McClellan, of the revenue marine service, who is in charge of the station, got the story which he tells about the relics. The shot, which weighs twenty-five pounds, struck the deck and bounded down one of the hatches, striking a woman between the shoulders, but doing her no injury beyond giving her a great scare. In the excitement attending the rescue the ball was detached from the line which it carried to the ship when fired out of the mortar. The hulk settled in the sand, and, like all such incidents, the wreck was soon forgotten. In 1875, twenty-five years after, a heavy gale set up a current in another direction and the sand was washed away, and once more the hull of the Ayrshire came to view. A party of wreckers going through the ship's hold came across the old rusted cannon ball. Its presence excited no little comment among the wreckers, and when they went ashore they told their story of the strange find in the hold of the Ayrshire. There were some of the people whe came over in the ill-starred ship still living in the neighborhood and they soon explained the presence of the big twenty-four-pound cannon ball. It was sent to the Smithsonian Institution in Washington, where, with the curious-looking old mortar and the life car, it has since remained. Only one life was lost in the rescue of the passengers and crew of the Ayrshire. It was that of a man who became too impatient to wait for his turn to go inside the car and insisted on going ashore on the outside. A heavy wave turned the car over and he was washed off and drowned.

© 1893 SCIENTIFIC AMERICAN, INC.

IMPROVED ELECTRIC RAILWAY CONSTRUCTION.

The illustration represents a conduit system railway with continuous metallic line conductors, but which may be operated with a single trolley wire with return through the rails, the conduit being always well drained and easily reached to make repairs. The improvement has been patented by Mr. George F. Moffett, No. 195 North Seventeenth Street, Portland, Oregon. In addition to the perspective view, with parts broken away, to show the improvement in use, Fig. 1 represents a cross section of the conduit, and Fig. 2 a section of the trolley support. The conduit walls are arranged to be taken apart in sections, being suspended by arch-shaped yokes and re-enforced by angle plates at opposite sides of the slot. The sleepers on opposite sides are connected by a nearly semicircular tie bar, and the conduit is strengthened by cross-braces, while drain pipes lead from its lower portion to the sewer. The conducting wires are held at intervals between clamping pieces on the upper ends of forked posts whose lower ends are held in a bed of insulating material in a cup or socket supported by brackets from the side walls. The double trolley employed with a continuous metallic circuit is composed of two similarly connected frames, insulated from each other, secured to a central vertical stem extending up through the slot, and so arranged that the trolley may be conveniently raised and the circuit broken when necessary. The trolley conductors extend through insulating sleeves at the front and rear of the stem, provision being made for a continuous circuit with the motor and the return of the current to one of the conduit conductors. The construction is such as to permit the car to pass easily around a curve without straining the trolley, and in front and rear of the conductors are vertical guide bars sliding in the slot to keep it open and remove obstructions. When a single conductor is used the trolley has but one frame, and the wires at the ends of the trolley conductors are connected together and also connected to one pole of the motor, from which the current is returned to the rails in the same way as in the overhead system.



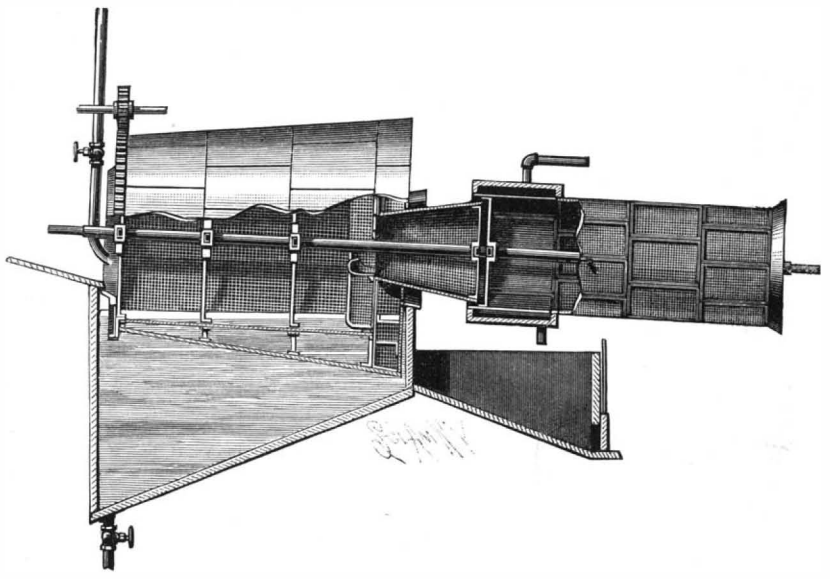
MOFFETT'S CONDUIT ELECTRIC RAILWAY.

Submarine Blasting.

The most extensive submarine blasting operation ever undertaken for the improvement of a harbor was that for the removal of the rocks known as Hell Gate, which obstructed the passage between New York Harbor and Long Island Sound. The works for the final operation in removing the middle reef consisted of the excavation of 21,669 feet of galleries through the rock, of an average section of 10 feet square, and involving the removal of 80,232 yards of rock by blasting. The total quantity of roof and pillars remaining to be shattered by the final explosion to a depth of 30 feet amounted to 270,717 cubic yards. The number of cartridges placed in the holes was 42,500, containing 240,399 pounds of an explosive consisting of potassium chlorate and nitrobenzol and 42,331 pounds of dynamite. The cost of the final explosion was $110,950, the total expenditure in breaking the reef being $1,094,000, exclusive of removing the shattered rock. The cost per cubic yard averaged $2.75. The total estimated cost of the Hell Gate improvement works amounted to $5,353,250. The work for breaking up the middle reef rock extended from June, 1875, to October, 1885, when the final explosion took place.

A MACHINE FOR WASHING, DRYING AND SEPARATING COAL, ORE, ETC.

This machine, patented by Mr. George H. Tench, of Pottsville, Pa., is comparatively inexpensive to build and is designed to do its work rapidly and automatically, being also adapted to do the screening under water to avoid creating a dust. It has an open-ended tapering drum, carried in nearly horizontal position by a shaft rotated by a gear from the driving shaft. A chute extending into the smaller end of the drum feeds the material to be screened, and the lower portion of the drum turns in water held in an inclined tank, supplied by a pipe delivering into the small end of the drum, the dirty water being let off through a pipe at the lower end of the tank. Arranged longitudinally in the drum is a cylindrical slightly inclined screen, whose lower portion is adapted to be submerged in water, and near the lower end of the screen is a circular transverse partition, having a central opening connecting with a supplemental tapering screen, there being on the inner face of the partition radial scoops delivering through the opening. The smaller end of the tapering screen is secured to the partition and its larger end is supported by spokes carried by the shaft. The end wall of the larger end of the drum is of screening material, and between the end of the drum and the partition is a second series of scoops made of perforated material adapted to raise dirt or other fine material passed through the longitudinal screen and deliver through an outwardly inclined ring, beneath which is a dirt pocket, the pocket having an inclined bottom and a door at its lower end to facilitate the removal of the dirt. The coal or other material discharged through the supplemental tapering screen is received in a cylindrical drier and separator also mounted on the shaft, and inclosed at its front end by a steam jacket connected with steam supply and exhaust pipes. The connection of the drier and separator with the washing and screening mechanism enables the entire operation of washing, screening, drying and separating to be carried on continuously and rapidly. The machine is especially adapted to wash, screen, dry and separate coal, culm, pebble phosphates, ore and similar material.



TENCH'S WASHER, DRIER AND SEPARATOR.

Pleasure Barge for an Indian Prince.

There has just been completed by Messrs. Messum, the well known boat builders of Richmond, to the order of the Nizam of Hyderabad, a pleasure boat peculiar in shape and, for its size, exceedingly costly in construction. Two boats of the size of a large skiff have been joined side by side by a deck, upon the extremities of which rise a number of finely carved pillars supporting a pagoda-shaped roof. The whole of the woodwork is of teak, a wood which is not warped by heat. As an instance of the great expenditure of labor upon the boat, which is only 28 ft. long by 14 ft. wide, it may be stated that the tiles of the roof are composed of some 3,000 small pieces of teak, most of which have had to be specially cut. There are no windows, but all four sides of the barge will be hung with pure silk of the richest quality, while the deck will be cushioned in the same costly way to a height of some feet. The barge will be propelled by two feathered paddles, placed between the bows and sterns of the two supporting boats and turned by handles after the manner of a small canoe. The barge is intended for use on a lake near to which the Nizam has a summer palace.

THE TWIN ELMS.

To the Editor of the Scientific American:

I take great pleasure in sending you photograph of the "Twin Elm Trees." They are located in Honey Creek Township, Iowa County, Iowa, one and a half miles northeast of the town of Kaszta, in the Iowa River bottom timber. They stand seven feet apart. It is thirty feet from the ground to where they unite.

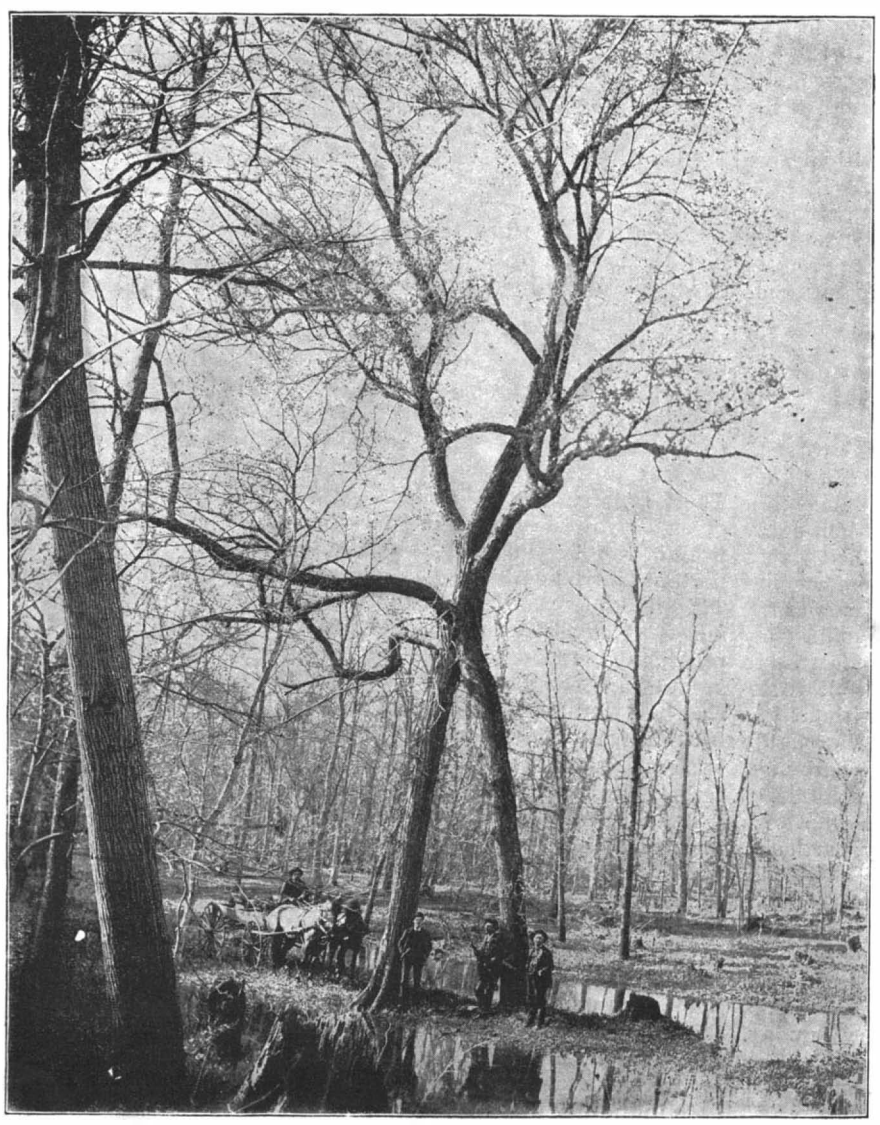
From the point of union it is three feet in diameter for at least ten feet.

Each body is two feet and six inches in diameter, and from the ground to the topmost twig it is fully ninety feet. The widest diameter of the tree top is about seventy-five feet.

I discovered the curiosity September 30, 1864. It was photographed May 14, 1893, by Mr. A. R. Brinkley.

WAYNE A. SULLENBARGER.

Belle Plaine, Iowa.



TWIN ELM TREES, IOWA COUNTY, IOWA.

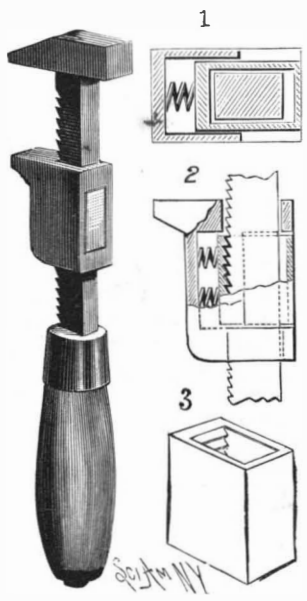
A Curious Method to Take Foul Air Out of a Well.

I saw, says a writer in the *Globe-Democrat*, a curious method used, the other day in Illinois, to take the foul air out of a well. The well was to be cleaned, but the man that took the job was afraid to go down until he had ascertained the quality of the air at the bottom. He let down a lighted candle, and when it descended to about six feet of the bottom it went out as suddenly as though extinguished by a whiff of air. That was all he wanted to know. He was then sure that the well had poisonous gas in it, and took a small umbrella, tied a string to the handle and lowered it open into the well. Having let it go nearly to the bottom, he drew it up, carried it a few feet from the well and upset it. He repeated this operation twenty or thirty times, with all the bystanders laughing at him, then again lowered the light, which burned clear and bright even at the bottom. He then condescended to explain that the gas in the well was carbonic acid gas, which is heavier than air, and therefore could be brought in an umbrella just as though it were so much water. It was a simple trick, yet perfectly effective.

© 1893 SCIENTIFIC AMERICAN, INC.

AN IMPROVED WRENCH.

The wrench shown in the illustration is of simple and durable construction and comprises virtually but three parts. It has been patented by Mr. Frederick B. Wells, of No. 50 Crescent Street, Montreal, Canada. The shank, which carries the outer jaw, has on one face a series of teeth, and sliding on the shank is a frame integral with the inner jaw, as shown in section in Fig. 2, this frame carrying a locking sleeve, shown separately in Fig. 3. Fig. 1 is a horizontal section showing the frame and locking sleeve in position on the shank of the wrench. The locking sleeve is capable of lateral movement in the frame and has on its front inner face teeth adapted to engage the teeth on the shank, the two sets of teeth being normally held locked by springs. To move the inner jaw toward or from the outer one the thumb is pressed against the back of the locking sleeve, forcing it inward against the tension of the springs, thus unlocking the sleeve, the thumb at the same time being used to slide the frame and sleeve inward or outward on the shank to effect the desired adjustment of the jaws. As will be seen, the wrench may be operated with one hand, leaving the other hand free and permitting the use of the tool in places inaccessible to wrenches requiring the use of both hands of the operator.



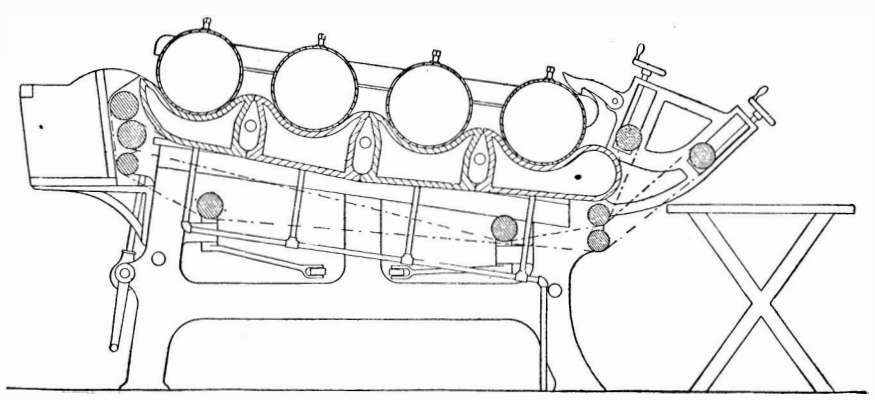
WELLS' WRENCH.

AN IMPROVED MANGLE.

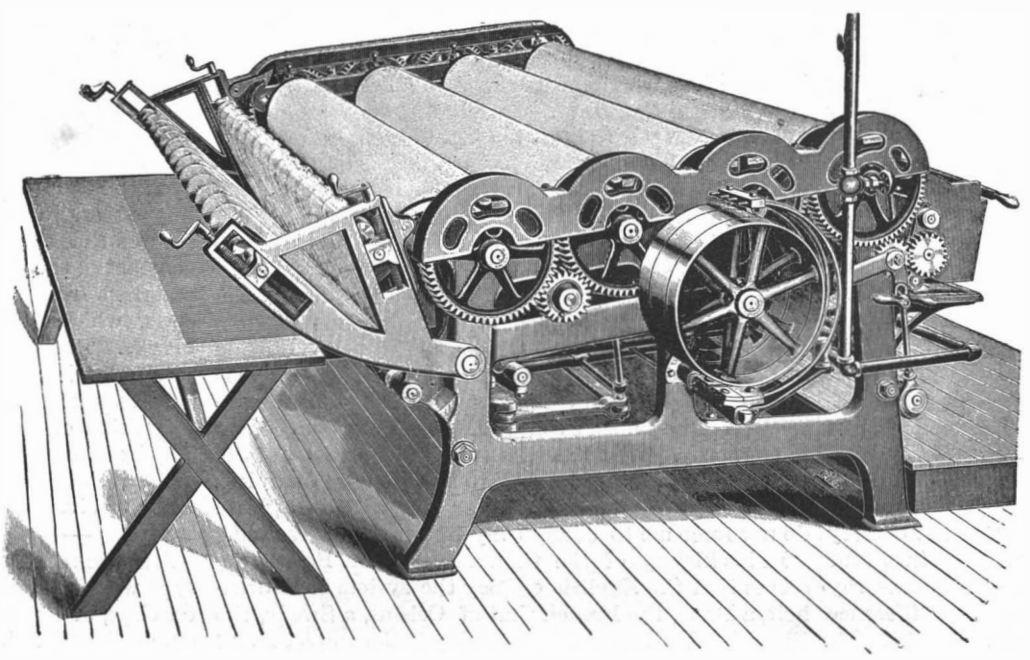
The demand made by large institutions and laundries for a mangle that will iron all kinds of flat work without having it first dried in a dry room has brought out several types of such machines. An illustration of this class of machinery appeared in the SCIENTIFIC AMERICAN of January 14. The one shown in the engravings, in perspective and sectional views, has been patented by A. T. Hagen & Co., Rochester, N. Y., manufacturers of modern laundry machinery, and is of very large capacity and gives an excellent finish to goods.

It consists of four steam chests placed parallel and close together, with their under sides planed straight and their upper sides concaved. Into each of these is placed a 12″ revolving roll. The goods to be ironed, after being wrung, are fed by an operator under the first roll and then carried by each to the succeeding roll. After being passed through the machine in this way, they are returned by means of an apron, tightly pressed against the under side of the steam chests and then carried back by another apron underneath the first one to the delivery side of the machine and deposited on a folding table.

The concaved surface of each steam chest measures about 11″ and the convex surface (or space between each roll) about 11″. Thus the goods, after being pressed against the heated chest under each roll, are exposed while passing to the next roll, allowing the steam to escape. After passing through the machine in this way, any dampness that may remain in the goods is taken out while on the moving aprons. One great advantage of this mangle is the small amount of floor space it takes up, considering its capacity; another, the absence of all stuffing boxes. This machine is provided with a device for changing the speeds to accommodate the different thicknesses of goods that it may be required to iron.



THE HAGEN MANGLE—SECTIONAL VIEW.



THE HAGEN MANGLE.

Tanning by Electricity.

At Turin experiments are in progress, under the direction of R. Pinna, in which hides are subjected to the action of weak alternating currents while immersed in the tanning liquor. A non-soluble metallic conductor, of about the same superficial area as the skins, is placed in the bottom of the tan pit and the hides are spread out and piled one upon the other on this conductor. The liquor is run in until this pile is submerged completely.

The second electrode is carried on a wooden framework, and is situated above the pile, being equal in size to the lower electrode. These electrodes are varied to suit the required current density. At present the current used is 0·04—0·10 ampere per square decimeter, according as the skins are light or heavy. The voltage is 50, and the frequency of the alternations 5,000 per minute. A rheostat is used for governing the current density and the temperature is kept below 35° C. Experiments are also in progress with hides stretched vertically and kept separate from each other, while the other conditions are the same. It is stated that an exposure of from 100–400 hours, according to the quality of the skins, is sufficient to convert the raw material into leather.

The Localization of the Perfumes of Flowers.

Mesnard's method of examining floral odors is applicable to a wide range of micro-chemical studies. A ring of glass is cemented to a suitable glass slide, and within this cell another smaller ring is glued, in such a manner as to leave between the two a clear annular space. In this space is placed pure chlorhydric acid. On a cover glass, large enough to cover the whole of the larger cell, is put a drop of pure glycerine containing a good deal of sugar, and in this reagent is deposited the section of petal to be studied. The cover glass is now to be inverted and applied to the outer ring. By the concurrent action of the vapor of the acid and the dehydrating activity of the glycerine, the essential or the fatty oil containing the perfume separates in minute drops.

A modification of the process directs that the central ring be covered by its own cover glass. On this the drop of glycerine is to be put, and this is to hold the sections.

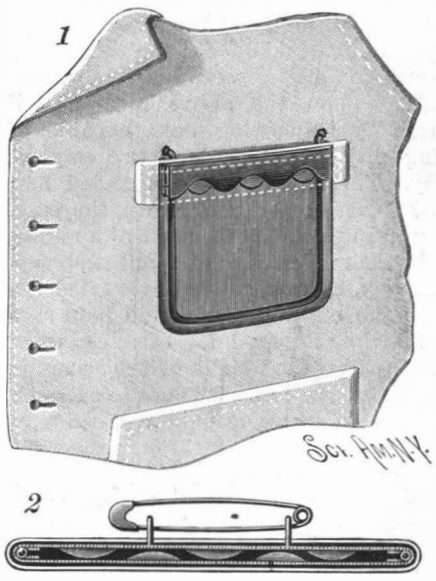
By this simple method, the localization of the perfume of the jasmine, rose, violet, and tuberose has been effected.—*G. L. G., American Journal of Science.*

Photography on Marble.

Mr. Villion publishes the following process: Coat an unpolished plate of marble with the following solution: Benzine, 500 parts; spirits of turpentine, 500 parts; asphaltum, 50 parts; pure wax, 5 parts. When dry, expose under a negative, in sunshine, for about twenty minutes. Develop with spirits of turpentine or benzine and wash in plenty of water. Now cover the plate where it is intended to be left white with an alcholic solution of shellac and immerse the same in any dye which is soluble in water. After awhile, when enough of the coloring matter has entered the pores of the stone, it is taken out and polished. The effect is said to be very good.—*Photographisches Archiv.*

A SIMPLE FORM OF SAFETY POCKET.

A safety pocket, more especially designed for carrying a watch, and which may be readily attached to or detached from a garment, is shown in the picture, and has been patented by Mr. Henry C. Diefenbach, of No. 124 Webster Avenue, Jersey City, N. J. A U-shaped wire frame has on its ends pintles for hinges connecting the ends of spring plates, having inwardly projecting teeth, as shown in Fig. 2, and this frame is placed in a separate pocket made of any suitable material, the spring plates forming the front and back edges of the pocket at its top. Fig. 1 shows such a pocket in position in a garment, to which it is secured by a safety pin passed through eyes extending inward from one of the plates. The upper ends of the wire frame have little knobs, and by pressing these toward each other with the thumb and one finger the spring plates open sufficiently to permit the convenient insertion or removal of the watch.



DIEFENBACH'S SAFETY POCKET.

Electricity at the Opening of the Fair.

The *Electrical Engineer* says: The devices for starting the engine and pump were connected in series with the key, and twelve cells of Exeter dry battery supplied the current. President Cleveland, in closing the circuit, first pressed the key lever, and then closed the circuit breaker, in order to keep the circuit closed and allow the starting mechanism time to act. The installation was made by Mr. L. Ethridge, superintendent of the World's Fair fire alarm service, and Mr. L. J. Auerbacher, electrician for The E. S. Greeley & Co.

The conductors were run under the platform and thence through the subway to the Allis-Corliss engine in Machinery Hall. Thence another wire extended to the pump house at the east end of the hall, where the great Worthington pump is situated. The electric fountains were operated by separate circuits from the northeast tower of Machinery Hall and were started by a signal in multiple with the main circuit. There was not the slightest hitch in the proceedings and everything worked to the perfect satisfaction of those in charge and the intense delight of the multitude.

The device used for opening the throttle of the great Allis-Corliss engine in Machinery Hall is the invention of Mr. Frederick D. Taylor, of Hartford, Conn.

The operation is extremly simple. When the circuit is closed, the armature is drawn toward its magnet, thus releasing the outer end of the tumbler. The shipping lever, then being free to move, is thrown over by its spring and withdraws the pawl from the ratchet on the barrel, leaving the latter free to revolve under the action of the powerful coiled spring within; and this motion is communicated by means of the shaft, sprocket wheels, and drive chain to the throttle valve of the engine.

An arrangement is also provided for mechanically releasing the spring barrel if desired by simply pressing upon the outer end of a rod whose inner end engages the pawl and moves it away from the ratchet. The whole device is inclosed in a handsome hardwood case.

THE diamond drill is pointed with black diamonds.

© 1893 SCIENTIFIC AMERICAN, INC.

Application of Electric Propulsion by Accumulators to the Tramways of Paris.

The Company of Tramways of Paris and the Department of the Seine has, for a few months past, been operating its Saint Denis lines by means of electricity furnished by accumulators. This new application of electric propulsion by means of accumulators is more important than any of those that have preceded it. The installation of the Saint Denis depot was made in view of the exploitation of two lines, each about 9,250 meters in length. Both start from the crossroads of Picardie, at Saint Denis, one running to the Madeleine and the other to the Opera House.

The programme laid out for the constructors of the motors and the electric accumulators was as follows: To replace, upon the above mentioned lines, the horse cars by self-moving ones, capable of accommodating fifty passengers and two employes of the company. The mean speed demanded for a full car was 12 kilometers per hour, with the possibility of reaching 16 outside of Paris, and 6 at a minimum upon heavy gradients of from 38 to 40 millimeters per meter. The company, moreover, desired that it should be possible that the electric cars should haul another car. The daily trip estimated for each car was 135 kilometers. Finally, the weight of the accumulators, including all the accessories, was not to exceed 2,800 kilogrammes. All these conditions have been fully realized.

The body of the car rests, through the intermedium of rollers, upon two single-axled trucks, carrying bolster pins, and connected with each other by a spring coupling, that permits the axles to converge on curves and brings them back to parallelism on a straight line. Each axle is actuated by a dynamo-electric machine by means of two sets of gearings. The ratio of the angular velocities of the motor and axle is 12 to 1.

The electric motors are bipolar, of the Manchester type, with Gramme ring armatures. The brushes consist of four blocks of carbon placed at right angles with the surface of the collector. Each machine, at a velocity of 1,300 revolutions, is capable of developing a power of 10,000 watts under a difference of potential of 200 volts. Under such circumstances, the rendering between the terminals of the dynamo and the axle reaches 73 per cent.

The trucks are provided with the Lemoine winding brake.

The battery, which is placed under the seats of the car, consists of 108 elements of 11 plates, contained in ebonite troughs. The plates are 0·2 meter in length, 0·2 meter in width, and 0·006 meter in thickness. The total weight of the active material of each element is 17·5 kilogrammes. These 108 elements are distributed among 12 wooden boxes, 6 on each side of the car. The 9 elements of each box are grouped in tension, and the poles of the small batteries thus formed each ends at a strip of copper fixed to one of the lateral sides of the box. Plates of brass, connected with the circuits of the dynamos through a coupling commutator, are mounted by springs upon wooden supports in the car. The introduction of the boxes between these plates, upon which slide the strips of copper, establishes a connection between the elements of the battery automatically.

The charging of the batteries is done upon benches formed of tarred planks, supported by bricks, from which they are separated by glass insulators. These benches carry spring contacts, similar to those of the axles of the cars. The battery, placed upon the charging bench, has all its elements grouped in tension. The accumulator hall now comprises 24 battery benches, each of which is connected with the distributing board of the charging current by a special circuit containing an amperemeter and an indicator of the direction of the current, and, upon each pole, a circuit breaker and an interrupter. The transfer of the batteries from the benches to the cars is effected through trucks running upon tracks alongside of the benches and the side tracks. The platform of the truck is raised or lowered by means of a screw and winch, so as to bring it exactly to the level of the interior of the car or to that of the charging bench.

The current is furnished to the accumulators by three Desrozier dynamos, each actuated by a Corliss horizontal condensing engine of 125 horse power. These engines are supplied by three semi-tubular boilers. The dynamos, at a velocity of 600 revolutions, furnish a current of 230 amperes under an E. M. F. of 260 volts. They, as well as the circuits of the batteries, are grouped in quantity. The charge is made at a constant potential. The duration of the charging is six hours for a battery that has furnished its whole capacity, which is 230 ampere-hours. The rendering of the batteries in energy is 70 per cent.

The necessities of the exploitation require the possibility of running at various speeds. This desideratum is realized by modifying the coupling of the battery elements. The battery is divided in the car into four parts, or sub-batteries, each including three boxes, say 27 elements in tension, that correspond to a difference of potential, in closed circuit, of about 50 volts. By means of coupling commutator within reach of the motorman, three different couplings may be obtained. The speed of the car varies, in passing from one coupling to another, in the ratio of 1 to 2.

The motors of the cars are normally associated in series, but it is possible, through the commutator, to couple them in quantity so as to obtain a greater speed or to develop a greater stress. The commutator permits, also, of changing the direction of the car by reversing that of the current in the induction circuit of the motors, and, in case of damage, of suppressing one of the motors. A single motor is capable of continuing the service with a slight diminution of speed.

The service of each car is assured by two batteries, that permit of four or six trips being made without recharging. In the latter case, the battery furnishes a motive power for a trip of 55·5 kilometers. The duration of a trip, including stoppages, is 55 minutes. The weight of the car, complete, is 13,500 kilogrammes, 2,600 of which are for the battery and its accessories and 3,500 for the passengers. The mean tractive stress is 12 kilogrammes per ton.

FALGUIERE'S STATUE "LA FRANCE" AT THE CHICAGO EXPOSITION.

The commissioners of the French section of the Chicago Exposition having decided upon the execution of a symbolic figure for the commercial section of the French exhibit, a statue of France was immediately thought of, and, in spite of the shortness of the time at their disposal, Mr. Roger Ballu, inspector of the

THE WORLD'S COLUMBIAN EXPOSITION—FALGUIERE'S STATUE "LA FRANCE."

Beaux Arts, asked the eminent sculptor, Falguiere, to undertake the task. Mr. Falguiere accepted, and in twenty days he had accomplished the work honorably. We give the original drawing, for which we are indebted to our contemporary *L'Illustration*.

France is represented seated and wearing a cuirass, the right arm being raised with a proud but pacific gesture. The left arm rests on a tablet bearing the inscription "*Droits de l'Homme*" (Rights of Man), while the left hand holds the national sword. The head, which is characterized by a calm and serene beauty, is ornamented with a diadem symbolical of liberty, equality and fraternity.

The statue is seven feet ten inches high, and will be erected on a pedestal nine feet ten inches high. It will ornament the French section, which is very remarkable as a whole and will attract much interest.

The Thermometric Systems.

We learn, says *La Nature*, that the Prussian government has just rendered legal the centigrade thermometric system, or that of Celsius as it is called outside of France. Apropos of this, a word of history: It is to the celebrated meteorologist Dove that is due the remains of popularity that the Reaumur system enjoys in Germany. While recognizing the advantages of the centesimal system, he said to his young disciples: "After my death you may do as you wish, but please do not force me to change my habits, I am too old."

In his history of the thermometer, Mr. Renou observes that the English employ the system of Fahrenheit, a Dane, the French that of Celsius, a Swede, the Germans that of Reaumur. We shall complete this paradox by saying that the Fahrenheit system was defined by Hanow, that of Celsius perhaps by Christin, and, finally, that originally the Reaumur thermometers marked a point in the neighborhood of 100° and sometimes higher for the temperature of boiling water. In fact, Fahrenheit graduated his thermometers by making 0° at the lowest temperature of winter and 24° in exposing the instrument to the sun. Later on, his degrees were divided into four parts. In 1737, Hanow wrote: "According to the most important thermometers that Mr. Romer, at Dantzig, has had constructed, and of which Mr. Fahrenheit is the best manufacturer, water boils at 212° and freezes at 32°." Celsius, to whom the thermometer owes great improvements, published the processes of graduation of his instruments in 1742. At this epoch he designated the temperature of boiling water by 0°, and that of melting ice by 100°. It was not till later on that he reversed his scale. At the same epoch Christin, of the Lyons Academy of Fine Arts, published a series of articles upon the graduation of mercury thermometers. It was in July, 1743, that he publicly proposed the division into a hundred parts. On the 11th of September, 1743, he wrote: "If the public wishes to adopt the division into one hundred degrees, I think it will do well; but if, on the contrary, it does not, I shall not be offended. I shall always have the satisfaction of having done my best." It will be seen, then, that the present centesimal division was proposed by Christin independently of Celsius. Who was the first to employ it? We believe that this point of history is not yet decided.

As for Reaumur, he established his system in the following manner: Having found by experiment that a certain quantity of hydrated alcohol, occupying a volume of 1,000 at zero, assumed the volume of 1,080 in boiling water, he defined, as a degree of temperature, the elevation necessary to expand this alcohol by 1-1000 of its volume. He thought that he had thus divided the interval comprised between the congelation of water and its boiling point into 80 parts. This definition was preserved in the system of Reaumur, although he himself determined the higher point of the scale by the temperature of ebullition of a certain alcohol. In reality, he divided into 80 parts an interval corresponding to about 80 of our present degrees, so that, in following the practice of Reaumur, and not his definition, thermometers would have been constructed graduated nearly according to the centigrade system. It was by grafting a bad process upon a bad definition that was established the system that physicists are now having much trouble to extirpate. Although the Prussian government has just decided upon the system to be employed, the imperial government had taken the lead by specifying that medical thermometers should be constructed of a certain glass (the normal glass of Jena), and that they should be officially verified at the Physico-Technical Institute of the empire. The latter has thus found itself obliged to compare as many as 90,000 thermometers a year. In France the liberty of the thermometer is absolute, but in England, the country of every liberty, the same is not the case. True or false, the origin of the law as to thermometers, as it is told us, is worth remembering. Once, when the Prince of Wales was sick, the thermometer used throughout his illness gave readings that were erroneous by two degrees. He came near dying, but as soon as he got well he set about preventing a repetition of such errors. Since then, 5,000 medical thermometers have been annually verified at Kew.

A Telegraph Decision.

A message filed with a telegraph company at a city in Texas, addressed to the sender's agent in California, read as follows: "Close the trade. I will come soon." On his arrival the sender discovered that the message had not been delivered, and that the deal had failed, thus requiring him to return to Texas. The court held that his expenses to and from California were proper items of damages against the telegraph company, but losses resulting from the sale of his property at a sacrifice before starting were not. The telegraph company having received full pay for transmission of the message to its destination, without any contract limiting its liability to its own line, was bound to deliver the message to the sender's agent, even though it had to be sent part of the way over the line of another company. The sender's testimony showed that the message was not written on a blank contract of the telegraph company, and that, when he returned from California, he examined the original copy, which was not then attached to one of such blanks. The company's agent testified that when he received the message he immediately attached it to a blank contract form, and that he was not authorized to receive or send a message unless on such blank. The testimony justified the court in finding that the message was not attached to a blank contract form when received by the agent.

A SUBSCRIBER suggests that there is a demand for a type writer for travelers, the machine to be of the better class, or two-handed, and not to weigh over eight or ten pounds. The type writer has become a necessity for many traveling men, and a light, portable machine would find many purchasers.

© 1893 SCIENTIFIC AMERICAN, INC.

Correspondence.

Feathers and Lightning.

To the Editor of the Scientific American:

It has been commonly believed that feathers were non-conductors of lightning, and timid people have often been laughed at for seeking refuge on a feather bed when lightning was shooting promiscuously about.

The members of our household have lost faith in the feather protection since one day in March of the present year, when our handsome Brahma rooster was killed by a stroke of lightning, the effects of which were felt some distance away. His post-mortem examination showed a badly blackened body, and the shock had passed the entire length of his spine. This is the first instance I have ever known where a chicken was struck by lightning in an open lot.

JOHN J. M. DAWSON.

Viroqua, Wis., May 15, 1893.

The Largest Flour Mill in the World.

To the Editor of the Scientific American:

When a journal enjoying the high reputation for candor and accuracy of statement which deservedly belongs to the SCIENTIFIC AMERICAN "slips an eccentric," it attracts the attention of its friends. In an article headed "Remarkable Dust Explosion," found in the issue of May 20, 1893, are the following remarkable sentences: "The great mill, said to have been the largest flour mill in the world, was blown to pieces," etc., and in closing, "The loss of the mills, which had a capacity of 2,000 barrels of flour per day," etc. Minneapolis is something of a milling town, and I am disposed to correct a statement that a 2,000 barrel mill is the largest flour mill in the world, or that any other city enjoys the distinction of having that mill.

Among the mills of Minneapolis, as well as of the world, the "Pillsbury A" stands at the head. Its capacity is 7,200 barrels of flour per day, which quantity has been actually made in the time. The "Washburn A" has a capacity of 5,200 barrels per day. The "Pillsbury B" follows with 4,000 and the "Washburn C" with 3,200. There are eight or ten mills in Minneapolis making more than 2,000 barrels of flour per day.

The "Pillsbury A" has five railroad tracks running to it. It handles all its cars by machinery, the daily demand being 200 to bring the wheat to and carry the products from the mill. One can hardly comprehend 36,000 bushels of wheat being ground into flour under one roof in one day, and the product being all removed. But this is the daily business, and it moves with the utmost accuracy and apparent ease. That this mill is a "wonder of the world" is shown by the fact that a register is kept as in a hotel, and the daily registration is from one to two pages of names of visitors from all parts of the world. Ushers are constantly employed in conducting parties through the mill, this feature being a characteristic of the courteous natures of the whole Pillsbury family. Minneapolis is the largest primary wheat market of the world, and the greater part of all the wheat coming to the city is made into flour in her mills. The Pillsburys lead, of course, and "Pillsbury's Best" is a familiar legend with the dealers in flour in all the marts of the civilized world.

E. L. OTIS.

Minneapolis, May 23, 1893.

Stars of the Milky Way.

A *Sun* reporter recently spent an evening in St. Louis with Prof. E. E. Barnard, of Lick Observatory. Prof. Barnard is the discoverer of sixteen comets, and he bears the reputation of being the keenest of all the eagle-eyed searchers of the heavens. He is yet a young man, and he is enthusiastic in the work he is now pursuing—photographing the Milky Way.

Original investigators are usually very careful to make no statements concerning their work which facts do not fully bear out, and Prof. Barnard was no exception to the rule. When asked how many suns there were in the Milky Way, he replied: "The old text books said the Milky Way probably contained 20,000,000 suns, but I can photograph more than that number in a five minutes' dry-plate exposure. We estimate pretty accurately that the Lick telescope shows 200,000,000 stars. Of course, you know that photography catches stars which the telescope does not reveal. The greatest revelations now coming to astronomers come along the line of stellar and nebular photography. Modern methods in astronomical photography are such as to give us a quite clear delineation of the Milky Way, nebulæ, and comets. Some of the negatives I have in this little case show us the growth and changes of comets and nebulæ in a most satisfactory way."

Prof. Barnard then exhibited three photographs of the comet which he discovered in October. The first showed the nucleus quite diffuse and the tail split in two sections. A negative made twenty-four hours later showed the head contracted, the tail shorter, and the sections closer together. Strangely, another photograph forty-eight hours later showed the tail elongated and the head condensed, giving evidence of a growth of many millions of miles in the tail in the two days which elapsed between the photographs.

"How many nebulous groups have you discovered in the Milky Way to date?" he was asked.

I have been at work on my photographs about two years, and I think I have found forty or fifty groups of nebulosity supposed to belong to the infant stages of world-making, according to the nebular hypothesis."

Prof. Barnard did not like to make an approximate statement of the number of stars in the Milky Way. Finally, however, he said:

"I do not believe I have half finished my photographs, and it will require three years to complete them, for it is tedious labor, which often requires many hours' exposure, at favorable times, aided by a delicate manipulation of fine instruments. At the conclusion of my labors I believe an estimate may be made, and I think these little specks will prove to be say 500 millions of suns. You must know that no known clockwork will move the instruments so as to keep a given star in one position, so the fingers must be used to adjust the camera. Furthermore, we have to wait long for just the proper conditions for this work."

Prof. Barnard's plates are the most complete and satisfactory ever undertaken, for, besides being an eminent and competent observer, he has been a photographer from childhood. Making photographs of the Milky Way interests him more than any other work he has ever undertaken, and the work has been fruitful in unlooked-for directions. It was while doing this labor that he noticed certain displacements and lights which led to the discovery of many comets. The photographs of suns so large that ours is a grain of sand on the infinite shores of matter in comparison do not show larger on his plates than the thousandth of an inch in diameter, while movements of mighty orbs at the appalling velocities of hundreds of miles per second are slower in the telescope than the creeping of the hour hand on a small clock's face.

"Yet a vaster thought," said Prof. Barnard, "is that the Milky Way, thickly studded as it is with giant stars, and resplendent with varied lights and magnitudes, shows that every star has back of it a luminous background of possibly millions of suns; and the black spaces on my negatives, which presumably show the vault of empty space, in reality represent billions of miles of the universe, which a longer exposure of the plates would probably people with infinite suns, each with its train of planets, surging with the throb of life and responsive to the control of law."—*New York Sun.*

Life in the Arctic Regions.

Dr. W. H. Neale writes as follows to the London *Times:* As medical officer to Mr. Leigh Smith in his two expeditions in the Eira in 1880 and 1881–82, I can speak with some experience of the advisability of choosing this route for an expedition which intends to spend the winter in the Arctic regions.

As you know, the Eira reached Franz Josef Land easily in 1880, about 150 miles of new coast line were discovered and accurately laid down in the chart, and the whole expedition returned to England the same year. In 1881 Mr. Leigh Smith again reached Franz Josef Land without any difficulty, but, unfortunately, while waiting for the ice to clear away from the land to enable further exploration, the Eira was crushed between the land ice and the pack, and sank about two miles from C. Flora on August 21, 1881.

Between the time the ship was crushed and her going down, we had about two hours to save provisions and clothing; during that time we were able to save enough bedding for all hands, and enough provisions to last us about two or three months.

It was not a very hopeful look-out for us. Twenty-five men to be left on an unknown land, with, at the outside, provisions enough for three months, with only four open boats, and a certainty that 12 months must elapse before we could be relieved, or take to our boats and effect our own escape. However, everything turned out well; within two weeks of losing our ship we had built a hut with stones and turf, and covered it with sails; in this 25 of us lived for ten months, without any case of illness appearing among us, after which we spent six weeks in our boats getting to Nova Zembla, where we met the Hope, which had been sent out to look for us under the command of Sir Allen Young. When I state that we had no lime juice, very few tinned vegetables, and very little flour, most people will be surprised that we all returned home, and never had a case of scurvy or sickness break out after the loss of the ship.

This clean bill of health was, in my opinion, entirely due to our being compelled to live on the food we were able to obtain by shooting the animals of the country. During the year we consumed 36 polar bears, 29 walrus, and over 2,000 loons. Every animal we shot was carefully bled before it was cut up, and every drop of blood we could save was kept in tins or pails. This blood was frozen within 15 minutes of its being obtained, and it was kept frozen until we wanted it for use; every day, if possible, about 1 lb. of blood was put into the soup, and by this means we had a daily supply of fresh blood. When I say fresh blood, I maintain that blood, frozen before it has time to coagulate, retains all the properties of blood just drawn from a live animal, and if you can keep men on this food during the winter, you will not know what scurvy is. If, on the other hand, we had saved enough tinned meats to last us through the winter, we should never have managed to make the crew eat fresh meat, and scurvy would have thinned our numbers long before the summer came. Only those who have been in the Arctic regions can know how a crew composed of whalers will do all they can to obtain tinned meats, and refuse bear or walrus as long as they have anything else to eat.

One good point, then, in favor of the Franz Josef Land route is the fact that there is an abundance of fresh meat to be obtained during the winter months, if you only have a rifle and a few cartridges. Another point in favor of this route is the mildness of the climate. Compared with that of Smith's Sound, where Sir George Nares wintered with the last English expedition, the climate of Franz Josef Land is decidedly mild, and the difference of the temperature charts of the two expeditions was much more than could be accounted for by Sir George Nares being two degrees further north than we were.

Fire Jets.

In a paper recently read before the American Water Works Association, Mr. J. T. Fanning dealt with the question of supply for fire service. First, as regarded the pressure necessary; as a general rule he thought that a pressure capable of throwing a jet 80 feet high was sufficient to meet the requirements of small cities and the suburbs of large ones. The lofty office buildings common in large American cities required, however, special methods. To facilitate the preparation of plans, Mr. Fanning has prepared the following table:

Vertical height of stream.	Diameter of nozzle.	Pressure at the play pipes.	Horizontal projection of streams.	Imperial gallons discharged per minute.	Pressure lost per 100 ft. of 2½ in. hose.
ft.	in.	lb. per sq. in.	ft.		lb. per sq. in.
70	1	46·5	59·5	162	10·75
70	1⅛	44 5	61·3	199	15·50
70	1¼	43	66	245	22·75
70	1⅜	41·5	67	292	32·50
80	1	59	67	184	13·50
80	1⅛	55·5	69·5	215	19 40
80	1¼	53·5	72.4	274	28·40
80	1⅜	51·5	74·4	328	40
90	1	78	76·6	214	17 70
90	1¼	72	78·5	259	25·40
90	1½	68·5	81	310	35 90
90	1⅜	65·5	82 6	374	51·40
100	1	125	88	249	23·50
100	1⅛	103	89	301	33 80
100	1¼	93	92	368	57·75
100	1⅜	88	92	432	72

Jupiter and His Satellites.

Dr. Wm. H. Pickering, Director of the Boyden Astronomical Station of Harvard University, at Arequipa, Peru, has made new and interesting observations relating to Jupiter and his satellites, which are set forth in the May number of *Astronomy and Astro-Physics.* He says:

The first conclusion to be drawn from these observations is that Jupiter is not self-luminous, but is only visible when it is illuminated by sunlight. The second conclusion is that it is surrounded by a rare atmosphere outside of its cloud surface, which is capable of producing a measurable refraction. This refraction has been computed, employing the observations at first and third contact, and these when the satellite was separated from the terminator by 0·5″ and also by its own diameter. Employing the third of these observations as our standard of comparison, the refraction of Jupiter's atmosphere at its cloud surface amounts to 0·59″. Employing the fourth observation as our standard, the refraction appears to be 0·38″. The third observation was probably the more accurate, but was partially vitiated since the satellite was not yet free of the planet's atmosphere, which is still sufficiently dense to produce an appreciable effect at an altitude of 0·8″ or 1,900 miles above the planet's limb. If we take the atmospheric refraction at the cloud surface at 0·50″ ± 0·05″, we shall probably be not far from the truth. That the atmosphere should rise to such a great height above the planet's surface was perhaps to be expected from the gradual character of the absorption of the planet's light near the limb. That such a height should be reached in spite of the high gravitation constant in those regions is an independent indication of a high temperature at the planet's surface, and a comparatively low temperature at an altitude of 1,900 miles above it. The faint glow seen beyond the dark limb of the planet for about a minute before the satellite made its appearance was doubtless analogous to the same phenomenon seen preceding the rising of our own moon, and may have been caused also in part by the illumination of clouds in the planet's atmosphere too small to be separately visible.

© 1893 SCIENTIFIC AMERICAN, INC.

Earthen Ware Ignition Tubes.

Ignition tubes for gas engines are now made of a composition consisting of kaolin, chalk, sand, and feldspar. These materials are ground up with water before being mixed, and the coarser particles are allowed to subside, the creamy fluids containing the finer particles in suspension are then mixed and allowed to settle. The paste deposited at the bottom is drained, kneaded, and stored for some months in a damp place. It is then moulded into the required shape, and dried by exposure to the air. The tubes are then packed in cylindrical cases of clay, and heated for fourteen days by the flame of a wood fire. Such tubes have lasted 546 days and showed no signs of wear, whereas a wrought iron tube is often destroyed in three days.

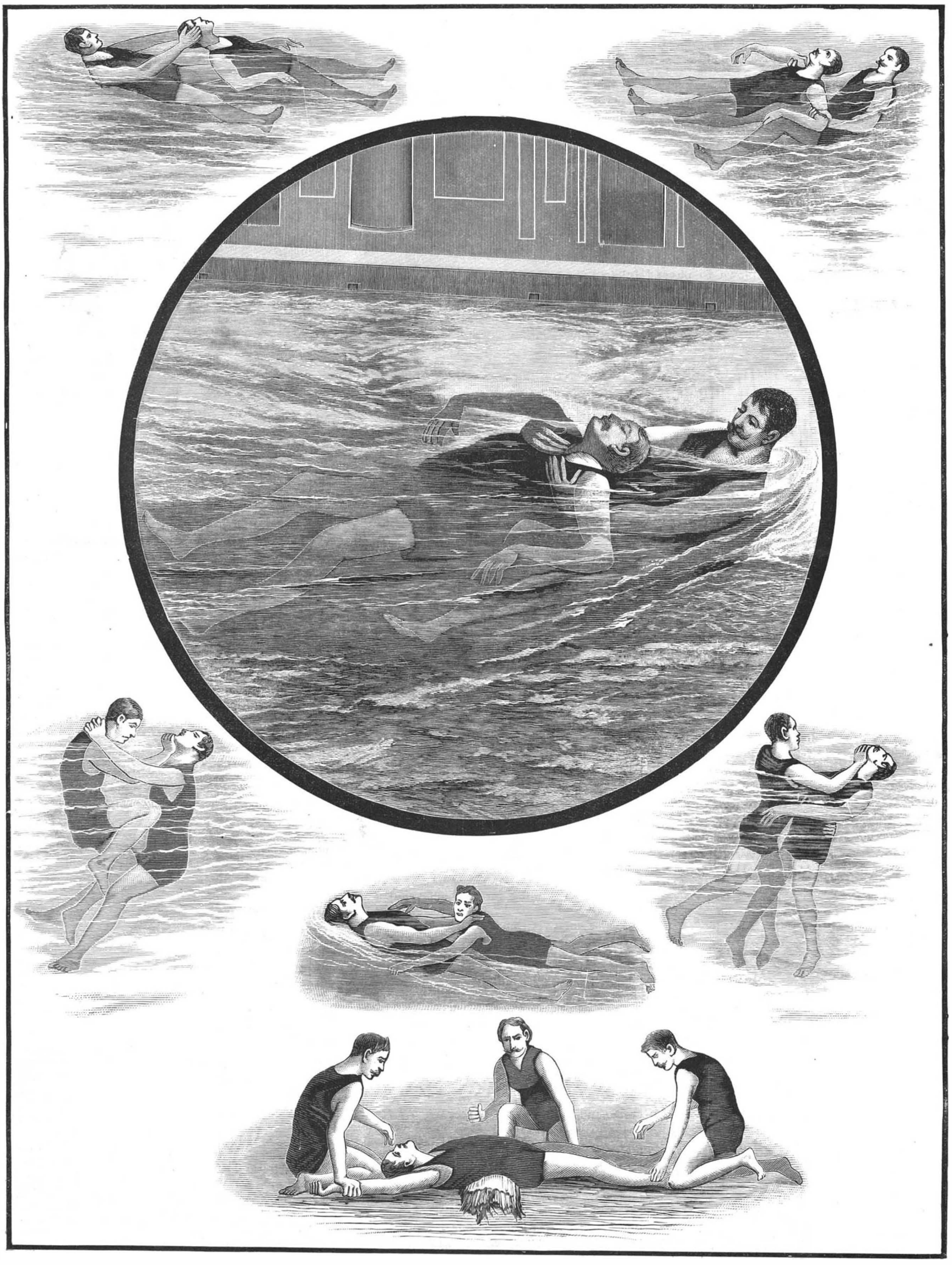
Photography of the Phonograph.

At the recent international congress of physiology at Liege, Prof. Hermann demonstrated his method of photographing the sound of vowels. The vowels were sung out before one of Edison's phonographs. Immediately afterward they were reproduced very slowly, and the vibrations recorded by a microphone. The latter was furnished with a mirror, which reflected the light of an electric lamp upon a registering cylinder, covered with sensitized paper and protected by another cylinder, with a small opening which gave passage to the rays of light from the reflector. By this means were obtained very distinct photographic traces, and the constancy was remarkable for the different letters.

Rescue Practice, First Method—The catch for one who may be quiet when rescued.

Rescue Practice, Third Method—A sure grip when the drowning subject is struggling violently.

Rescue Practice, Second Method—A firm grip when the person being rescued is struggling.



Release Drill—To release one's self when clutched round the neck.

Rescue Practice, Fourth Method—Used in carrying a disabled or tired swimmer. Resuscitation Drill—"Sylvester" method of producing artificial respiration.

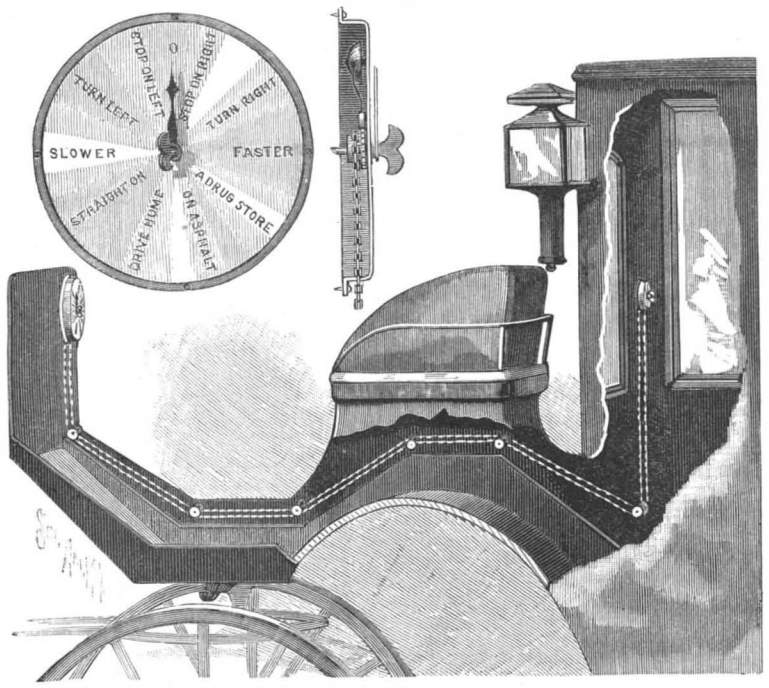
Release Drill—To release one's self when clutched round the body.

METHODS OF RESCUE FROM DROWNING AS PRACTICED AND TAUGHT BY THE LIFE SAVING SOCIETY.—*From Black and White.*

© 1893 SCIENTIFIC AMERICAN, INC.

BLAKE'S CARRIAGE INDICATOR.

The difficulty of making the driver hear directions given from within a moving carriage when one is riding in a closed vehicle often causes no little inconvenience, to obviate which is the design of the improvement shown in the accompanying illustration. Attached to the dashboard, conspicuously in view of the driver, is a dial on which is marked a variety of the most usual directions, such as "stop on right," "stop on left," "slower," "faster," etc., as shown in one of the views, there being also on the face of the dial an indicating hand adapted to be moved by the occupant of the carriage to either of the special directions. The shaft on which is the indicator hand is moved by a sprocket chain, which extends downward and beneath the seat (as shown in the broken-away portion of the large view) to the central shaft of a similar dial within the carriage, provided with a thumb screw, whereby the shaft and the indicating hand may be turned to any desired point, such movement simultaneously turning the indicator of the dial on the dashboard to direct the driver. As the indicator hand is turned, a toothed wheel on the shaft of the outside dial, as shown in the sectional view, engages and tilts a dog operating a hammer which strikes a gong to attract the attention of the driver. To facilitate the use of the improvement at night, electric lamps may, if desired, be arranged to illuminate the dials, such lamps being connected with a suitable battery carried in a convenient place in the carriage and arranged to be connected up to light the lamps by the movement of one of the dial hands. In applying the improvement to different kinds of carriages the positions of the dials may be changed as desired, the operative connections being correspondingly arranged.



A CARRIAGE ATTACHMENT FOR SIGNALING THE DRIVER.

Further information relative to this improvement may be obtained of the patentee, Mr. Arthur M. Blake, Washington building, No. 1 Broadway, New York City.

Family Relations in Japan.

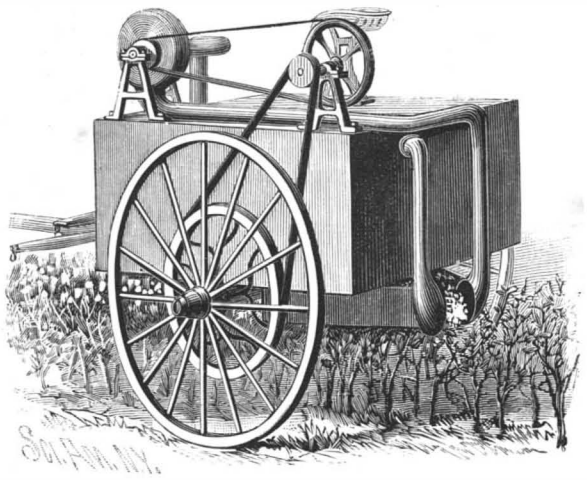
A meeting of the Japan Society was held recently in London, Sir E. J. Reed, M.P., presiding, when Diayoro Goh, the Chancellor of the Imperial Japanese Consulate-General in London, read a paper on "The Family Relations in Japan." The lecturer dwelt in commencing his paper upon the peculiarities of the religions and family systems in Japan, which he described at some length, and remarked that the ethics of the Japanese people were kept up in a great measure by domestic instruction. The family system was founded on love and reverence, as, indeed, was the case in Great Britain, and the only difference between the two countries in this respect was that it was carried out in different degrees. The Japanese reverenced their elders more than the English people did. Referring to the relations of the sexes, he stated that the inferior position of woman in Japan was due to the influence of the Chinese over a lengthened period. Dealing in detail with the relations between parents and children, he remarked upon the importance of the paternal powers and rights, and described the systems of child life and education, the arrangements in regard to marriage, and the laws relating to succession, divorce, and the settlement of family disputes. Amid much laughter, he stated that the mother-in-law in Japan was not the terror to the son-in-law as in this country, but the position was reversed, and the wife stood in extreme terror of her husband's mother. The most important duty of the parents was to find matrimonial companions for their sons and daughters, and the non-fulfillment of that duty was regarded as a disgrace both to the young people and to the parents. The Japanese children were brought up under a compound system of bitter and sweet, under which the father was supposed to be strict, while the mother was benevolent. In fact, according to the Japanese idea, one of the four terrible things in the world, three of which he described as earthquakes, thunderstorm, and conflagration, was the strict father. The lecturer finally alluded to the relations between brothers and sisters, husband and wife, and master and servant.

Diamonds at the Columbian Exposition.

A very complete diamond exhibit is made by Cape Colony, South Africa. The exhibit includes 10,000 carats of uncut stones, a large quantity of very fine cut and polished ones, together with all that is necessary to show the process of mining and washing. For this it has been necessary to transport to Chicago 100 tons of pulverized blue earth, 50 tons of unpulverized earth and a complete washing machine, which will be operated by natives. The exhibit will also include a unique collection of crocidolite and special diamondiferous products.

PNEUMATIC COTTON PICKER.

The illustration represents a machine designed to pick cotton by the simultaneous action of blast and suction pipes, whereby the bolls will be removed from the plants and conveyed through a tube to a cotton box on a vehicle. The improvement has been patented by Mr. Gustav A. Mauermann, of San Antonio, Texas. A blower driven by a belt from the vehicle axle draws the air from the interior of the cotton box, within which a partial vacuum is created, the mouth of the pipe leading from the box to the blower being protected by a screen to prevent the picked cotton from being drawn into the blower. A blastpipe from the blower extends rearward, terminating at a point about as high as the average cotton plant, and directly opposite the mouth of this pipe is a suction pipe leading into the rear end of the box, the space between the mouths of the two pipes being sufficient for the passage of the cotton plants. Suspended by hangers from the bottom of the box are rearwardly converging fenders, their ends reaching very close to the mouths of the pipes, and when the machine is drawn over the rows of cotton plants these fenders are designed to guide the plants so that the bolls will be brought within the powerful air current of the blast and suction pipes, whereby the cotton will be cleanly and rapidly picked and delivered into the box.



MAUERMANN'S COTTON PICKER.

THE 100 TON STEAM HAMMER AND THE LARGE ROLLING MILL OF THE ETAINGS WORKS.

We have already had occasion at various times to point out to our readers the continuous development and the incessant transformations that the *materiel* of large forges is undergoing in view of the preparation of military products. As well known, artillery is daily trying to increase the offensive power of its engines, the rapidity of fire of its guns and the penetration of its projectiles. On their side, military and naval engineering are improving the efficiency of defense by increasing the bulk and strength of the organs of protection that they are capable of opposing to an attack that is daily becoming more dangerous. In order to satisfy the exigencies of this ceaseless contest, the iron-working industry has had to make continuous modifications in its equipment, so as to put itself in shape to handle heavier and heavier ingots and the products of increasing dimensions that are now demanded of it.

We have at various times described the most important of these large tools, and we believe it of interest to return to the subject in calling attention to the recent setting in operation of two apparatus in the works of the Marrel Bros. at Etaings (near Rive-de-Gier), iron masters whose names are justly honored in the industry. We find herein a new proof of the incessant efforts of our great forges and of the continuous sacrifices that they do not hesitate to make in order to ever remain in a position to respond to the needs of the national defense in the preparation of

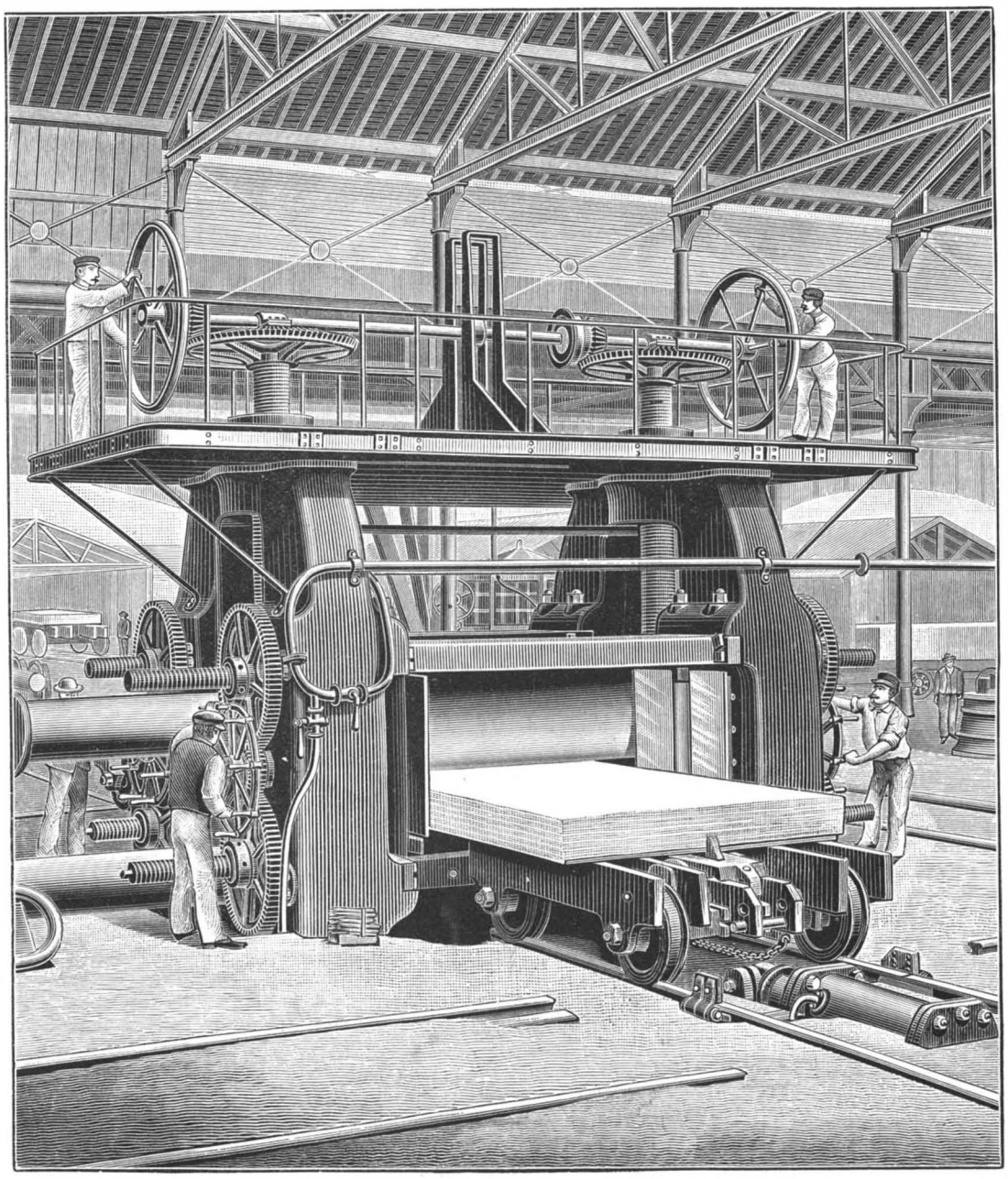


Fig. 1.—ROLLING MILL OF THE ETAINGS WORKS.

© 1893 SCIENTIFIC AMERICAN, INC.

the military *materiel* that is destined to play so important a part in the contests that the future has in store for us.

The rolling mill and steam hammer of the Etaings works may both be cited as being among the most powerful of such apparatus now existing. These works, moreover, are provided with a 350-foot chimney, one of the highest that exist in France.

The armor plate rolling mill of the works, which was installed in 1868, has been transformed and enlarged since the month of February last. It is represented in Fig. 1 at the moment of the passage of a large armor plate that it has just finished.

The cylinders of this train, which weigh 66,000 lb. each, are 3·28 feet in diameter, with a table 10·8 feet in length. They are capable of flatting ingots and fagots of all thicknesses up to 4 feet. This apparatus thus permits of obtaining those large plates of 20 inches in thickness, and of a finished weight that often reaches 66,000 lb., that are now demanded for the armoring of ships. Laterally the apparatus includes two vertical cylinders 4·25 feet in height, that are capable of being moved toward each other in order to produce a certain pressure upon the narrow sides of the fagot during the flatting.

The movable journals of the cylinders rest in vertical guides which receive, in addition, the transmissions of motion. The vertical rollers, moreover, are arranged in these cages when it is desired to do the flatting through the whole extent of the horizontal cylinders. The weight of each of these cages is 94,600 lb.

In the figure may be seen the various transmissions of motion that permit of regulating the distance apart of the horizontal and vertical cylinders.

The Messrs. Marrel's large power hammer has a height of fall of 18·4 feet and a total weight of 100 tons. This apparatus possesses an energy of impact greater that that of any analogous hammer in France, and probably in Europe. It can be exceeded, we think, only by the hammer of the Bethlehem works of Pennsylvania, the weight of which is 120 tons, but the height of fall of which we do not know. The rolling mill, by reason of the great length of its cylinders, is capable of working pieces of larger dimensions than can be handled elsewhere. Fig. 2 gives a general view of the power hammer under consideration, as well as the vertical boilers of the reheating furnaces that supply this apparatus. There may be seen, besides, the large crane used in conjunction with it, and the power of which amounts to 180 tons, thus exceeding that of any other lifting apparatus hitherto constructed. At the same time an idea may be had of the huge proportions of this apparatus, the summit of which, situated at 62 feet above the floor, seems as it were to pierce the roofing of the large hall that gives it shelter, while, with its imposing mass, it dominates all the neighboring accessory apparatus, which themselves have had to have their size increased in order to proportion it to its own. It is in the spectacle of the maneuvers of this huge machine that may be especially admired the action of intelligence dominating brute force. This heavy mass obeys, in fact, an impulsion that is insensible in appearance, and one sees it violently strike the glowing ingot, which it works in projecting sparks that form a true aureola to it, while the floor trembles and everything is agitated around it, owing to the vibrations that it transmits. When the docile giant, ever guided by a hidden intelligence, wishes solely to give the last form to the piece that it has just shaped, one sees it descend gently, in restraining its force, in a measure, so as not to injure the metal, and only making the minor corrections that are to bring out the final contour with all its sharpness.

Such oppositeness of effects and such facility of regulation assume so much the more interest when it is a question of larger masses, the least movement of which seems destined to bring about irresistible shocks. The hammer rests upon an independent anvil block, which itself constitutes a colossal mass, for the total weight of this piece amounts to no less than 1,670,000 lb. This block is arranged in a trench formed to this effect between the beds of the uprights. It is placed upon a bed of oak resting upon courses of stone supported by the solid rock, so that it is capable of withstanding, without danger, the violent impacts of the 100 ton hammer. It is composed of blocks connected with each other by hoops and forming four courses, the three lower ones of which include pieces of 90 tons each. As for the upper course, that is in a single piece, the weight of which amounts to 125 tons.

The two uprights are in two pieces and are carried by cast iron plates firmly anchored in the masonry and cross-braced by strong cast iron pieces, so that the support is of absolute rigidity. The uprights are 35 feet in height and are cross-braced at the center by strong plates, and connected at the summit by an iron entablement upon which is placed the steam chest surmounted by the large cylinder that crowns the whole. The piston of the cylinder is connected with the hammer through a rod 15 inches in diameter. The piston itself has a diameter of 6½ feet and a stroke of 18·4 feet. The mass of the metallic colossus thus constituted represents a weight of no less than 2,970,000 lb. In the figure may be seen the arrangement of the hall, with the central lantern and the two trusses that consolidate the hammer. The span of this hall is 85 feet.—*La Nature.*

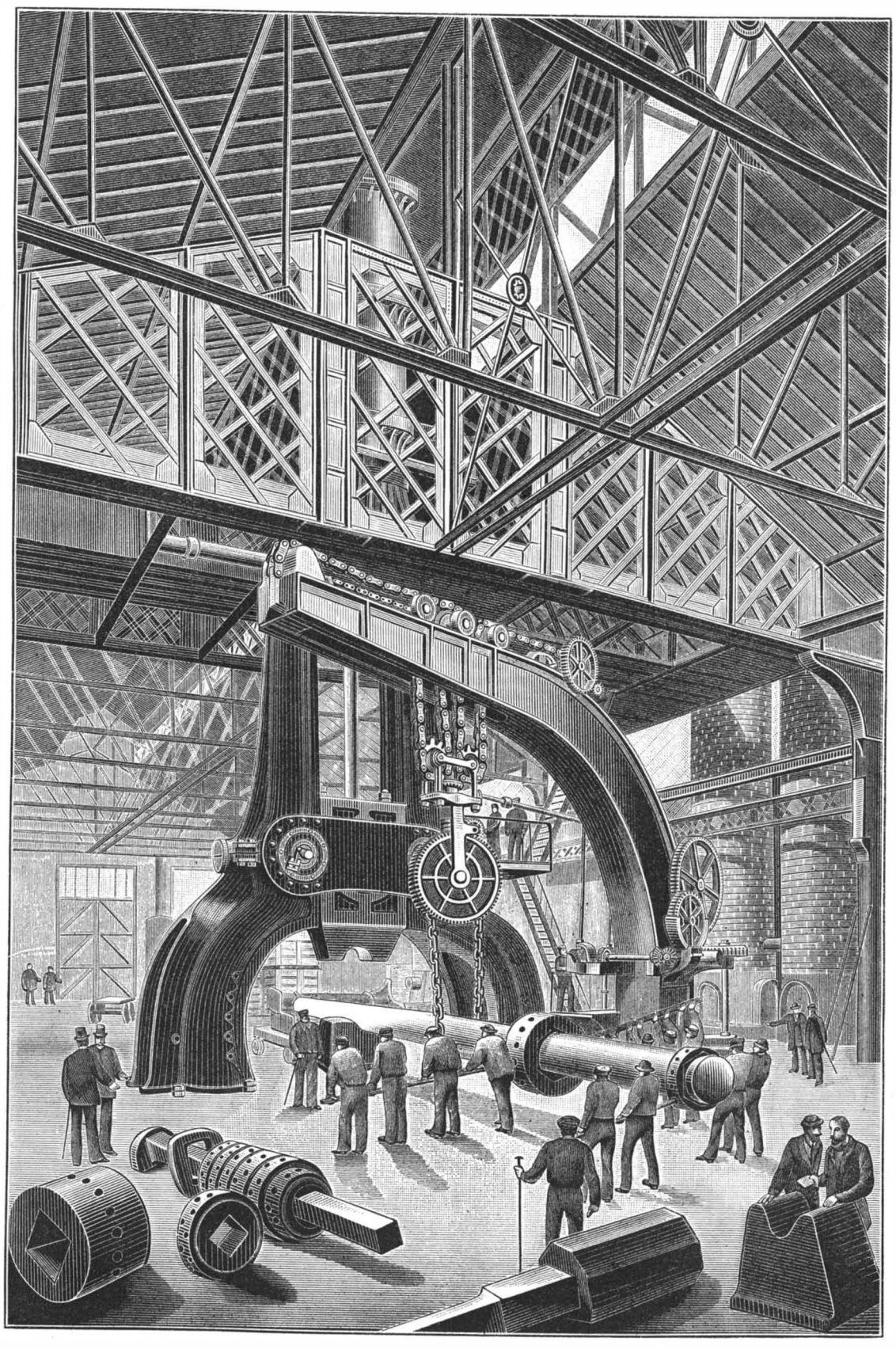


Fig. 2.—POWER HAMMER OF THE ETAINGS WORKS.

Engineering in Mexico.

At a recent meeting of the Engineers' Club of Philadelphia, President Birkinbine referred to some of the engineering features which impressed themselves upon him during a recent trip in Mexico, and contrasted the journey which he made by railroad and in sleeping cars with one covering a portion of the same territory made eleven years ago in diligencias and on horseback, noting the improvements made, but calling attention to the tenacity with which older methods and appliances are still adhered to. He referred to the difficulty of locating and constructing railroads in a country where the supplies, and even the water, had to be carried long distances, and instanced the necessity at present of some of the railroads attaching one or two tank cars of water behind the locomotive tender, so as to cross waterless plains of one hundred miles or more.

He gave a table of the different elevations of the 6,831 miles of railroad in the republic of Mexico, which showed that three-fourths of the entire railroad mileage in Mexico is at elevations greater than are reached by any of our Pennsylvania railroads. About one-half is above a level of 5,000 feet above tide and one-half below that height. Of the higher portion, some 200 miles of the tracks are laid from 8,000 to slightly over 10,000 feet above sea level.

He described the general alignment and profiles of the various railroads, and illustrated this by diagram; referred to the difficulties of construction and cost of some of the roads, and laid stress upon the liberal use of metal sleepers, which meet with favor from engineers, managers, and contractors. He also discussed the measures which had been taken in former times to drain the city of Mexico, and referred to the present canal and tunnel, the former requiring the handling of 12,000,000 cubic meters of earth.

After discussing the existing conditions in Mexico, which lead many investors astray, namely, the cheap labor and high cost of fuel, reference was made to the numerous important aqueducts and the possibilities of irrigation being carried on upon a liberal scale by the erection of large dams on the mountains. The publication of an engineering periodical in Mexico by a former Philadelphian, the National Engineering College and its curriculum were mentioned, and incidental reference was made to the large number of meteorites which have been discovered in Mexico, some of them of enormous size. One mass of meteoric iron now at the museum of the college is in two parts, the pieces weighing together about twenty-five tons.

The address was illustrated by diagrams and by lantern slides, showing some of the engineering structures, crude methods of handling used by natives, and closed with some picturesque views of the mountains and of the growth of and manipulation of "pulque."

IN the British Patent Office, where of all places in the world one would expect to find things ordinarily well "up to date," the steel pen is unknown, and the antediluvian goose-quill supreme.

© 1893 SCIENTIFIC AMERICAN, INC.

RECENTLY PATENTED INVENTIONS.

Railway Appliances.

CAR COUPLING.—Nicholas J. Hopkins, Owen Sound, Canada. The coupling link of this device is flat, and has on each end a latch notch, adapted to be engaged by a spring-pressed vertical pin, the pin pressing against the side of the link to hold it in position to enter an approaching drawhead. A yoke engaging the ends of the pin is connected with a lever at the side and a hand wheel at the top of the car, whereby the pin may be drawn out of the path of the latch hook to uncouple the car. The device is quite simple and inexpensive, the coupling being automatic and the uncoupling being effected from either the top or the side of the car.

RAIL SUPPORT.—William N. Morrison and Thomas P. Swin, Brooklyn, N. Y. Two patents have been issued to these inventors for rail-supporting devices, one of the patents providing for a series of base plates or chairs to be secured on the ties to support the stringer, over which are fitted casings, one for each chair, the ends of the casings having flanges to engage recesses in the sides of the chairs, while the tops of the casings form shoes or rests for the rail, the sides of the casings extending upward to prevent lateral displacement of the rail. The spikes which secure the rail to the casing fasten the latter to the stringer. The other patent provides a support to securely hold the rail in place without spikes or bolts. The support is provided with a cap of approximately inverted U shape, its top portion having a rail seat formed by longitudinally extending integral flanges, while the rail web has longitudinal interlocking flanges adapted to engage the flanges of the cap.

Agricultural.

PLOW.—William B. Wherry, Overton, Texas. An improvement in land sides for plows has been perfected by this inventor, the land side being adapted to be quickly and conveniently removed from the shank plate, while the latter is so made that the share when placed on it will be firmly held in position and prevented from slipping vertically. There is an interlocking connection between the land side of the shank plate and the land side proper, bolts firmly uniting one part with the other, and yet admitting of the ready removal of the land side.

STUMP PULLER.—Thomas A. Terrell, New Whatcom, Washington. This is a machine of but few parts, very durable, which can be readily moved from place to place, and which can be quickly and conveniently operated. A drum mounted on a frame has ratchet wheels on the ends of the drum shaft, segmental frames extending over the ratchet wheels, while levers pivoted on the frames have a virtually hinged connection with dogs engaging the ratchet wheels, the latter being also engaged by pawls pivoted on the frames. The levers are worked up and down to draw upon the drum the rope or chain attached to the stump to be pulled.

THRASHING MACHINE ATTACHMENT.—Richard Keeling, Walhalla, North Dakota. This is a separator device to receive the straw from the thrashing cylinder of the machine, thin out and loosen it, and fan it in such manner that the chaff will be separated from the straw, permitting the grain to more readily fall down through the straw and rattle rake of the machine. The invention is very simple, and capable of application to any form of thrashing machine, providing for a quick and ample separation of the grain from the straw without in any way injuring the latter.

Miscellaneous.

TYPE WRITING MACHINE.—Edgar H. Berry, New York City. This invention consists principally of a single key lever connected with two type bars and having a changeable fulcrum. Two oppositely pivoted type bars are adapted to act on the same impression cylinder or surface, in combination with a single key lever and two rods connected with it on opposite sides of its fulcrum, and pivoted at their upper ends to the type bars on opposite sides of the fulcra of the latter. The machine is designed to be of simple and durable construction, not liable to get out of order, and is arranged to print two different type characters by the use of the same key.

PLUMB LEVEL.—Lee J. Rogers, Pomona, Cal. This is a combined plumb and level in which the stock casing has a central socket in which is fitted a metal casing open at its top and bottom, a weighted pendulum carrying an upwardly extending pointer being pivoted on a bail longitudinally adjustable in the lower part of the casing. By this means the bearing of the pendulum can be quickly adjusted so that the index point will register true with the gauge line on the upper plate.

PUMP GEARING.—Stanley L. Fulford, Los Angeles, Cal. This gearing is designed to successively and rapidly actuate a number of pumps with the full power of the motor, the invention consisting of a series of cross heads mounted to slide in stationary bearings and connected with the pump plungers to successively reciprocate them. Any desired number of pumps may be actuated in this manner, the several plungers being successively moved by the full power of the motor.

OIL WELL AGITATOR.—Thomas H. Gallagher, Olean, N. Y. This invention affords means for agitating the large cavity often formed by blasting in drilling a well, thus facilitating the cleaning out of all the sand at once. The working sections of the improvement correspond somewhat to an ordinary drill jar, but there are hung in these sections radially swinging arms which normally lie vertically, these arms being thrown violently out in a radial swing as the working section is churned up and down by the working of its connections from the top of the well

MACHINE FOR COLORING SKINS.—Albert F. Jones, Salem, Mass. Revolving coloring brushes are, by this invention, arranged in pairs, in combination with tanks and attached perforated sprinkling pipes discharging coloring fluids upon the brushes, while an endless skin carrier has cross rods or wires over which the skins may be folded, the carrier passing between the brushes of each pair. The machine is more especially designed to operate on sheep and goat skins, the brushes rubbing the coloring liquid on and into the skins most effectively, and none of the coloring material being wasted.

VEHICLE RUNNING GEAR.—John Q. A. Haney, Buckhannon, West Va. In the construction designed by this inventor, half axles are used, there being a single independent axle for each wheel, each axle being fixed to the wheel at its outer end, and the bearing box supporting the outer end of the axle is pivotally connected with a bed or bolster, so that the wheel may turn laterally. The invention also covers other improvements, the gear being especially adapted for rough and uneven roads, and means being provided for automatically turning the rear wheels when the forward wheels are turned.

REIN HOLDER.—Homer C. Davis, Normalville, Pa. This is a device to be attached to the dashboard of a vehicle, and consists of an upper presser bar operated on by a spring to hold the reins between it and a lower bar or frame. The right and left hand reins are laterally introduced between the clamping devices from opposite ends.

WINDOW.—Everett C. Horton, Jersey City, N. J. This invention provides hinged and laterally spring-pressed closing strips to be held on the side bars of the sash in a window casement, thus automatically closing the crevices at the sides of the sashes, and also affording means for the support of the sash at any desired point of adjustment. The improvement facilitates the easy movement of the sashes, while insuring tight joints and compensating for changes in thickness of the sashes due to expansion or shrinkage.

ROOFING AND SIDING STRIP.—James W. Hammett, Eureka, West Va. These strips are formed of inner and outer sections pressed at their adjacent faces against sheets of tin or other material, the adjacent faces having corrugations, the ridges of which come opposite each other, forming hollows or dead air spaces, which prevent the wind from carrying rain, snow or cold air through the roof or siding. The sections are drawn together upon the roofing or siding material by clamps or screws.

GUITAR.—Christian F. Hartmann, Bethlehem, Pa. The neck of the guitar, according to the improvement provided by this invention, may be quickly and conveniently removed from connection with the body, thus facilitating the storage or carrying of the instrument. Means are also provided whereby the neck of the guitar may be adjusted to cause the strings to approach as close to the frets as may be desired.

ORGAN ACTION.—William Schwarze, Brooklyn, N. Y. An action mechanism designed to give a quick response from the pipes or reeds of an organ when the keys are touched is provided by this invention. In the pressure box is located a valved bellows, and a trip mechanism opens the valve when the bellows is compressed, so that the bellows will be inflated by the air in the pressure box, so that upon the slightest pressing of a key the proper tone of that key will be immediately sounded. This action may be conveniently applied to an organ of any description. A further patent, embracing especially means for operating pressure box bellows or organs, was granted this inventor, providing means for obtaining a quick response between the keys of organs and their pipes, and enabling organ keys to be manipulated with the same facility as piano keys.

COFFEE MAKING POT.—Cordula Ackerman, Pekin, Ill. This pot has a lower hot water and steam reservoir, and an upper compartment for the coffee, the latter compartment having in its top a perforated metal sieve-like receptacle in which the ground coffee is placed to be infused. Fitted loosely in the bottom of the hot water compartment is a close metal hot water retainer, a tube from which passes upward through a sleeve and has on its top a bent spout that passes steam and water on the coffee to infuse it. The apparatus is continuous and self-feeding, and the coffee can be kept hot without cooking it over again, thus especially recommending the improvement for use in hotels, restaurants, etc.

STOOL AND FOOT REST.—John K. Phillips, South Orange, N. J. This is an article of furniture of neat appearance, especially designed for use in shoe stores. The foot rest is so arranged that when not in use it may be readily swung under the stool, out of the way. A front panel is also provided in the stool, to receive an advertisement, the panel in a measure concealing the foot rest when the latter is not in use.

CLOTHES DRIER.—Elihu H. Thomas, Brattleboro, Vt. This is a device for attachment to the outside of a window, and consists of a frame carrying parallel guide rods and a rack, together with a series of clothes-receiving rods having each an independent sliding connection with the guide rods, and also adapted for engaging the rack. The lines or rods upon which the clothes are to be placed may be drawn into the room and supported while the clothes are being hung in position, the rod with its clothes being then carried outside and locked in place with the clothes suspended.

FISH HOOK DISGORGER.—Frank T. Verharen, Spencer, Iowa. This device has a shank by which it may be conveniently held in the hand, and at its outer end is a hook adapted to fit closely upon the fish hook, there being on the shank, opposite the hook, a guard or shield, preventing the hook of the disgorger from being caught in the membranes of the fish's mouth while the fish hook is being dislodged.

Designs.

SPOON.—Austin F. Jackson, Taunton, Mass. The leading feature of this design consists in the ornamentation surrounding the edge of the head portion of the handle, there being continuous head and side scrolls and bead-like representations.

NAPKIN HOLDER.—Joseph Walter, New York City. This design is of a holder provided with a base having four ornamented legs, the curved band extending upward from a perforated flat bottom portion being also highly ornamented.

WAGON HUB BAND.—Charles C. Field, New York City. This design provides an annular internal bead or flange on the inside of the hub band at its front edge, the bead or flange being approximately half round in cross section.

NOTE.—Copies of any of the above patents will be furnished by Munn & Co., for 25 cents each. Please send name of the patentee, title of invention, and date of this paper.

NEW BOOKS AND PUBLICATIONS.

SUBURBAN AND COUNTRY HOMES. Containgdesigns for houses of moderate ecst contributed by various architects, together with "Suggestions on House Building." By A. W. Cobb, Architect, and "How to Plumb a Suburban House." By Leonard D. Hosford. New York: William T. Comstock, 23 Warren Street. 1893. Price $3.

This very handsome work is a collection of plates, with brief descriptions giving a great variety of country houses from the plans of different architects, whose names are stated in each case. The price is also given in many instances, so that the prospective builder of a home has a good chance of knowing in advance just how far he is going if he follows the plans. In some cases, of course, it is given only approximately, and in other cases it is undoubtedly very close to the truth—for all the prices are not given. Where stated costs generally range from $4,000 to $6,000, and exceedingly good results seem to be reached thereby. Yet one very pretty cottage with six rooms only costs $1,500.

MUNICIPAL IMPROVEMENTS. A manual of the methods, utility, and cost of public improvements, for the municipal officer. By W. F. Goodhue. New York: John Wiley & Sons. 1893. Pp. viii, 129. Price $1.50.

The subject of municipal improvements is one which is every day acquiring importance in this country. The subject seems to be excellently treated by Mr. Goodhue, under different headings, sewerage, street sprinkling, water works, municipal franchises, paving, bridges, assessments, and city finances, as well as the board of health work all being included in it. Lack of an index mars the work, although its place is taken to a certain extent by an alphabetically arranged contents.

THE MEASUREMENT OF ELECTRIC CURRENTS. Electrical measuring instruments. By James Swinburne. Meters for electrical energy. By C. H. Wordingham. Edited by T. Commerford Martin. Illustrated. New York: D. Van Nostrand Company. 1893. Pp. ii, 237, iv. Price 50 cents.

This volume includes two papers presented before the Institution of Civil Engineers, and they embody an excellent and practical treament of the titular subject. The book forms an excellent addition to the well known Van Nostrand Science Series.

ABROAD AND AT HOME. Practical hints for tourists. By Morris Phillips. New York: Brentano's. Pp. 365. Price $1.

This discursive work is really best described by its title. In it some general points about a number of popular points of travel and resort are given with adequate illustrations. A summer resort guide with hotel rates and other information of that character fill the last of the 365 pages of the book. The preface is by A. Oakey Hall, appropriately dated from the Lotos Club. London, Paris and the United States are the principal subjects treated. The book, from its sketchy and graphic character, is excellent reading. In addition to the illustrations in the text, it contains a portrait of the editor.

ELECTRICAL TABLES AND MEMORANDA. By Silvanus P. Thompson and Eustace Thomas. London: E. & F. N. Spon. New York: Spon & Chamberlain. 1893. Pp. v, 128. Price 50 cents.

This tiny work, of vest pocket size, will be found acceptable by the engineering profession. It naturally is written from the English standpoint, and is adapted largely to English practice.

OUTLINES OF FORESTRY; OR, THE ELEMENTARY PRINCIPLES UNDERLYING THE SCIENCE OF FORESTRY. By Edwin J. Houston. Philadelphia: J. B. Lippincott Company. 1893. Pp. 254. Price $1.

Professor Houston in this book has departed from the realms of physics and electricity and given us what he terms a series of primers, 18 in number, upon the forest. The subject seems to be excellently classified, very practical, is illustrated by numerous quotations, and will be found, with its appendix and very full index, an excellent contribution to a very important subject.

ELECTRICAL MEASUREMENTS AND OTHER ADVANCED PRIMERS OF ELECTRICITY. By Edwin J. Houston. New York: The W. J. Johnston Company, Limited. London: Whittaker & Co. 1893. Pp. 429. Price $1.

Professor Houston here gives us 18 primers on his titular subject. As in the book just reviewed, the last section is termed the primer of primers, a sort of summarization or collection of points which did not fall within the preceding chapters. The work will be found a creditably written one and a very acceptable addition to the literature of electricity.

CATALOGUE OF SWEDISH EXPORTS. Edited by Wilhelm Tesch. Stockholm: Royal Printing Office. P. A. Norstedt & Soner. 1892. Pp. 219.

STANDARD TABLES FOR ELECTRIC WIREMEN. By Charles M. Davis. New York: The W. J. Johnston Company, Limited. 1892. Pp. 100. Price $1.

This work, with its simple, clear illustrations and concise directions, will be found an excellent addition to the working equipment of the practical electrician. It is written entirely from an American standpoint. In the advertising department, an alphabetical list of works on electricity is not the least valuable part of it. Among the books cited certain are marked with an asterisk "as most likely to furnish reliable information on the subjects of which they treat." We strongly suspect that a different distribution of the asterisk might have been made without doing the system any injustice.

ALTERNATING CURRENTS OF ELECTRICITY: THEIR GENERATION, MEASUREMENT, DISTRIBUTION AND APPLICATION. Authorized American edition by Gisbert Kapp. With an introduction by William Stanley, Jr. New York: The W. J. Johnston Company, Limited. 1893. Pp. 166. Price $1.

Gisbert Kapp, whose efforts have so often taken the form of reducing electrical mathematics to a practical shape, in this work attacks the subject of alternating currents. From its briefness and practical treatment the work will be a favorite one with the working engineer. The alternating current system is of growing importance and much remains to be done before it will be on the same footing, as regards formulation, with the constant direction current.

The Moslem World is the title of a singular description of paper to be printed in the English language, which has just been started in New York City by Mohammed Alexander Russell Webb, an American who has lived several years in Mohammedan countries. It is the purpose of the paper to diffuse a knowledge of Mohammedanism, as it is known to its editor, and to urge the establishment of missions throughout the country for the conversion of people to the doctrines of Islam. Whatever may be the success of such a project, Mr. Webb has at least succeeded in getting himself widely talked about by his efforts, and the first number of his paper is very creditable to its publisher.

☞Any of the above books may be purchased through this office. Send for new book catalogue just published. MUNN & Co., 361 Broadway, New York.

SCIENTIFIC AMERICAN BUILDING EDITION.

MAY, 1893.—(No. 91.)

TABLE OF CONTENTS.

1. Elegant plate in colors, showing an elegant residence at Bridgeport, Conn. Floor plans and two perspective elevations. An excellent design. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
2. Plate in colors showing a handsome residence at Rutherford, N. J. Two perspective views and floor plans. Mr. F. W. Beal, architect, New York. An attractive design.
3. A handsome dwelling at Plainfield, N. J. Perspective views and floor plans. A model design. Messrs. Hartwell & Richardson, architects, Boston, Mass.
4. A dwelling at Utica, N. Y., erected at a cost of $4,700 complete. Floor plans, perspective view, etc. Mr. W. H. Symonds, architect, New York. An Old Colonial style of architecture.
5. Engravings and floor plan of the Fairfield Congregational Church at Fairfield, Conn., erected at a cost of $52,000. Messrs. J. C. Cady & Co., architects, New York City.
6. A stable erected at Plainfield, N. J. A model design. Messrs. Hartwell & Richardson, architects, Boston, Mass.
7. An excellent design for a modern stable at Bridgeport, Conn. Messrs. Longstaff & Hurd, architects, Bridgeport, Conn.
8. A residence at Belle Haven, Conn. A very picturesque design, perspective elevation and floor plans. Cost $6,000 complete. Mr. Frank W. Beal, architect, New York City.
9. View of a tasteful shop for a builder erected at Neuilly, Paris.
10. The Fifth Avenue Theater, New York.—View of the Worthington steam fire engine pump.—View of the Hygienic Cement and Asphalt Company's watertight scene pit. View of the Edison Electric Illuminating Company's switchboard, with particulars of construction, etc.
11. Miscellaneous contents: A Pacific coast bathing establishment.—An improved spring hinge, illustrated.—The Lewis open fire base burner, illustrated.—The J. A. Fay and Egan Co.—The H. W. Johns paints, etc.—An adjustable sash holder, illustrated.—A labor saving screw driver, illustrated.—A self-feed rip saw, illustrated.—Shipping a factory across the Atlantic.—Architectural wood turning.—Tunneling the Simplon.—New resawing band saw machine, illustrated.—The Wheeler wood filler.—An improved hip shingle, illustrated.

The Scientific American Architects and Builders Edition is issued monthly. $2.50 a year. Single copies, 25 cents. Forty large quarto pages, equal to about two hundred ordinary book pages; forming, practically, a large and splendid MAGAZINE OF ARCHITECTURE, richly adorned with elegant plates in colors and with fine engravings, illustrating the most interesting examples of Modern Architectural Construction and allied subjects.

The Fullness, Richness, Cheapness, and Convenience of this work have won for it the LARGEST CIRCULATION of any Architectural Publication in the world. Sold by all newsdealers. MUNN & CO., PUBLISHERS, 361 Broadway, New York.

© 1893 SCIENTIFIC AMERICAN, INC.

Business and Personal.

The charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in the following week's issue

Order pattern letters and figures from the largest variety. Knight & Son, Seneca Falls, N. Y., drawer 1115.

Acme engine, 1 to 5 H. P. See adv. next issue.

"U. S." metal polish. Indianapolis. Samples free.

Stave machinery. Trevor Mfg. Co., Lockport, N. Y.

Improved iron planers. W. A. Wilson, Rochester, N.Y.

Chain Belting & Grain Dryers, F. H. C. Mey, Buffalo, N. Y.

For stone quarry engines. J. S. Mundy, Newark, N. J.

Microbe Killer Water Filter, McConnell Filter Co., Buffalo, N. Y.

Universal and Plain Milling Machines.
Pedrick & Ayer, Philadelphia, Pa.

Steam Hammers, Improved Hydraulic Jacks, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

All kinds of Perforating done in every kind of metal F. Erdle Perforating Works, Rochester, N. Y.

Will purchase patent of meritorious small article. Give particulars. Manufacturer, box 2238, New York.

Screw machines, milling machines, and drill presses. The Garvin Mach. Co., Laight and Canal Sts., New York.

Centrifugal Pumps. Capacity, 100 to 40,000 gals. per minute. All sizes in stock. Irvin Van Wie, Syracuse, N.Y.

Fine machine & model work. Prices low. Workmanship unexcelled. J. L. Crandall, North Attleboro, Mass.

To Let—A suite of desirable offices, adjacent to the Scientific American offices, to let at moderate terms. Apply to Munn & Co., 361 Broadway, New York.

The best book for electricians and beginners in electricity is "Experimental Science," by Geo. M. Hopkins. By mail, $4; Munn & Co., publishers, 361 Broadway, N. Y.

For the original Bogardus Universal Eccentric Mill, Foot and Power Presses, Drills, Shears, etc., address J. S. & G. F. Simpson, 26 to 36 Rodney St., Brooklyn, N. Y.

Canning machinery outfits complete, oil burners for soldering, air pumps, can wipers, can testers, labeling machines. Presses and dies. Burt Mfg. Co., Rochester, N. Y.

Competent persons who desire agencies for a new popular book, of ready sale, with handsome profit, may apply to Munn & Co., Scientific American office, 361 Broadway, New York.

Any Manufacturer

of hardware or machinist's specialties, desiring to be represented in New York City and vicinity, will find it to his interest to address E. J. Hussey & Co., 80 John Street, New York. We are centrally located, active workers, and can furnish best of references.

☞ Send for new and complete catalogue of Scientific and other Books for sale by Munn & Co., 361 Broadway, New York. Free on application.

Notes & Queries

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters, or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

Books referred to promptly supplied on receipt of price.

Minerals sent for examination should be distinctly marked or labeled.

(5101) L. S. F. asks: Please let me know how to soften plaster of Paris, to take the collar off a lamp, and why there is an air vessel on the suction pipe of a pump. I have seen one on the pump of the Hone brewery. The pipe runs over a high bank, the air vessel is as high as the bank next to the pump. A. Place the lamp in water with a little soda and boil it, to soften the plaster. Air chambers are put on suction pipes to prevent water hammer.

(5102) A. C. H. asks: Please give me information as to how moss is cured and prepared for use. A. Moss is soaked in water tanks until the bark is rotted, then dried and the bark whipped off in the same manner as flax and hemp.

(5103) L. H. S. asks: What is estimated to be the temperature in a perfect vacuum? Could a body suspended in a vacuum be heated by applying heat to the outside of the vacuum? Could meat be cooked in a vacuum pan? A. A vacuum should have the same temperature as the surrounding walls. Bodies that do not evaporate may be heated in a vacuum by radiation. Meat could be cooked in a vacuum pan. Meat or anything containing water neutralizes a vacuum by vaporizing.

(5104) R. W. H. writes: I would like to know how diamond drills are made and whether they can be made to drill hardened steel. A. Diamond drills are made by setting the borts or small black diamonds in the edge at the end of a brass or steel rod or tube, so that the diamond cuts the hole clear of the metal. They will bore hardened steel.

(5105) A. B. says: Kindly inform us the best means to prolong the life of clarinet reeds. Should they be oiled? A. Soak the reeds in boiled linseed oil and thoroughly dry.

(5106) J. M. writes: We have a boiler 4 feet diameter which we are building. How wide and how deep should our fireplace be immediately above the grates, and how much space should there be behind the grates in depth and width? A. The fire chamber should be 4 feet 2 inches wide, 2 feet from grate to boiler shell for coal. Back chamber 4 feet 2 inches wide and full depth to level of ash pit.

(5107) H. Bros. ask: To settle a dispute please answer in Notes and Queries. Was the Great Eastern iron or wood? Also date of building of first iron vessel. A. The Great Eastern was an iron vessel. The first iron vessel was built in England in 1787. The first iron steamer also in England in 1821. Iron ocean steamers were commenced in England in 1833.

(5108) G. D. — To prevent shrinkage corks may be treated with paraffine. Melt the paraffine and boil the corks therein, kept below the molten mass. Remove the corks, dry on a cloth. In case the cork has a tendency to slip out, rub with powdered chalk. Rubber corks may be used for alcohol, but not for ether and essential oils.

(5109) W. S. C. asks: Will you kindly inform me through your Notes and Queries if it would be advisable to use an H armature in the motor described in "Experimental Science"? A. A drum armature or ring armature is preferable, and one or the other of these should be used when it is possible.

(5110) J. T. McC.—The plant sent for identification is the yellow milkwort, *Polygala lutea, L.*

(5111) F. S. asks if it would be better to make a casting for the field magnet and armature of a small dynamo. A. A field magnet might to advantage be made of cast iron, but it is not well to use cast iron in the core of the armature.

(5112) C. C.—The lowest temperature so far obtained by artificial means is 491° Fah. below freezing. Pictet has succeeded in reaching this wonderful result.

(5113) C. C.—The normal speed of Parsons latest steam turbine is twelve thousand revolutions per minute.

(5114) F. H. asks: 1. How can chemical action be prevented in the Bunsen battery on an open circuit, the zinc being amalgamated? A. It cannot be entirely prevented without removing the zinc from the solution. 2. How can the deposit of zinc sulphate on the amalgamated plate be prevented? A. By renewing the solution frequently. 3. Which would be the best, cheapest, and most durable filling for a Bunsen battery in order to run a Swan lamp of 8 v. 0·8 a., by using four batteries, and still prevent chemical action on an open circuit, as I use the lamp every day for an average of 4 hours a day? A. A solution of chromic acid for the porous cell and dilute sulphuric acid for the jar, with a small percentage of bisulphate of mercury added to keep up the amalgamation. 4. Please give the description, the voltage, amperage, resistance, and durability of the Fuller battery. A. 2 volts, resistance 2 ohms, amperes 1. 5. Could I run an 8 volt 0·8 ampere Swan lamp on an average of 4 hours a day (sometimes even 6 hours) by the following method: I use two 1·6 v. batteries, giving a current of 1·6×2=3·2 v. The batteries are 16 centimeters high; with this I charge for 20 (sometimes 18) hours two storage batteries, each 22×13 centimeters (*i. e.* the size of the jar containing the lead coil), and what battery would be the best for charging? A. For an 8 volt lamp you would require 4 storage cells, and for each storage cell you would require 4 cells of gravity battery for charging.

(5115) J. A. writes: I am making the permanent magnet telephone described in your SUPPLEMENT, No. 142. I have been careful to follow measurements exactly, but succeeded in winding only ½ ounce of 36 covered wire on the spool instead of ¾ ounce. Will this amount do, or must I make a spool larger than your directions and wind upon it full ¾ ounce? Should the binding posts come in contact with diaphragm? A. Probably you could wind three-fourths of an ounce of wire on the spool if you are careful to wind the wire as thread is wound on a spool; however, your telephone should operate fairly well with half an ounce of wire. The binding posts should not touch the diaphragm.

(5116) H. V. F. asks: 1. Will it increase the power or distinctness of the telephone described in SUPPLEMENT, No. 142, Fig. 5, to add a soft iron cap, or a piece of soft iron ⅜ or ½ inch long, same size of magnet, to the coil end of magnet? A. No. 2. What cheap book tells how to make test instruments, as voltmeter, ammeter, resistance coils, etc.? Price? A. "Instrument Making for Amateurs," by S. R. Bottone, price by mail 50 cents, will probably answer your purpose. 3. I wish to make an induction balance similar to the one described in the SCIENTIFIC AMERICAN, issue of August 20, 1892. Please inform me of the size and amount of wire in the primary coils, size and amount of wire in secondary coils, size of primary spool and of hole, size of secondary spool and of hole? Is the primary placed inside of the secondary or beside it? Is the arrangement the same for the movable coils? Is any core needed? If coils are placed side by side, should the core extend through both? A. We have not the precise measurements of the instruments, but we think you will be able to get at the proportions by referring to SUPPLEMENT, Nos. 184, 289, 196, and 429.

(5117) F. W. Q. asks: 1. If I have a manometer tube containing air at a pressure of one atmosphere, and send a half inch spark from a Leyden jar through it, how much would the pressure increase? A. It would depend entirely upon the quality of the spark and the quantity of air contained in the tube. 2. Is there any advantage in reading by sound in cablegraphy, over reading the signals by light? A. There would be an advantage if the Morse code could be used.

(5118) L. M. W. asks: 1. What should be the resistance of a small motor to be run by one cell of Grenet battery? A. 2 or 3 ohms. 2. Can aluminum be used for electric contacts in place of platinum? A. It is not a good substitute for platinum.

(5119) J. W. S. writes: I want to make a small dynamo to light my engine and boiler room. Will you please give me the dimensions for a dynamo to make about 8 or 10 lights? My fly wheel is 13 feet in diameter and 4 inches face. Could I run it with a friction pulley? And about how much power would it take? I have a 360 light Edison dynamo. Could I use the same switchboard for the small dynamo? A. Without doubt you could run your small dynamo by a friction pulley in the manner suggested. It will probably require a little more than one horse power. You can doubtless use your switchboard for the small machine.

(5120) R. C., Iowa.—I send you by this mail a sample of maple wood which is infested with some insect. Will you please let me know what it is, and if it is liable to injure our maple grooves, which are quite useful to us for shelter? All the samples were taken from one tree, about four years old. Answer by Professor Riley.—The maple twigs which Mr. Carithers sends comprise some of last year's growth and some of the season of 1891. The formerexhibit longitudinal rows of closely connected punctures, while the latter show simply an old scar, with no indication that the twigs are unhealthy. The punctures have been made by the snowy tree cricket (*Oecanthus niveus*) in laying its eggs. A longitudinal slit through the twig shows the somewhat curved eggs laid side by side, with their axes horizontal to the axis of the limb. Beyond damaging vegetation in this way the snowy tree cricket does little harm, since it is partly predaceous (feeding upon plant lice and other small insects), and does little harm by its other method of feeding, which consists in gnawing the leaves. The specimens of the second year's growth which Mr. Carithers sends are particular interesting, since the woody layer which has grown on the side of the punctures is nearly as thick as that on the opposite side, the former being 3 mm. in thickness and the latter somewhat less than 4 mm. This indicates that with the maple the twigs are not necessarily injured by this oviposition. With blackberry, raspberry, and grape, however, in which the insect more usually lays its eggs, the twigs are frequently killed. The only satisfactory remedy consists in pruning the infested canes during the winter time and burning them with the inclosed eggs.

(5121) F. E. H. writes: I have a spring that furnishes 477 gallons of water per minute. There is a fall of 84 feet in the first 75 yards, then there is a gradual fall of 50 feet in the next 400 yards, to the bed of creek. Please tell me the proper size of pipe to use to keep the pressure the same on a jet water wheel. Please give size of pipe to start with, and the sizes all through. What size nozzle can I use, and about what horse power would there be with a good jet water wheel, with the 134 foot fall? A. It will require an 8 inch pipe the whole distance, with a conical enlargement to 10 inches at the spring. This will cause a friction loss of about 3 feet in the head. A 1½ inch nozzle will discharge the full flow of the spring and give you 12 horse power on a 24 inch Pelton wheel.

(5122) C. R. asks: How much water do ½ and ¼ and ⅛ inch nozzles discharge in one minute? Head 75 feet, no friction. And what horse power will nozzles give with 3 and 4 foot Pelton water wheel, same head? A. ½ inch nozzle will discharge 5·66 cubic feet per minute = $\frac{68}{100}$ of a horse power; ¼ inch nozzle will discharge 1·41 cubic feet per minute = $\frac{17}{100}$ of a horse power; ⅛ inch nozzle will discharge 0·354 cubic foot per minute = $\frac{4.3}{1000}$ of a horse power. The above size nozzles are only suitable for 12 inch, 8 inch, and 6 inch wheels.

(5123) B. W. C.—A dip for brass is as follows: Strong sulphuric acid, 2 parts; water, 1 part; red fuming nitrous acid, 1 part. These must be mixed in the open air, as the gas evolved on mixing the nitrous acid with the vitriol and water is of a suffocating character; this will pass off in the course of an hour or so, during which time the mixture may be occasionally stirred with a glass rod. The bright, gilded effect produced on the brass by this mixture is so good that any one trying it will not return to the use of nitric acid. The subsequent washing, drying, and lacquering cannot be done too soon after the dipping, as the articles tarnish rapidly if kept unlacquered.

(5124) Secy. Y. M. C. A. says: Our members greatly enjoy your valuable paper, and we have thought you could probably make it more valuable to us if you would kindly give us through its columns recipes for cleaning carpets and wall paper. A. 1. A dusty carpet may be cleaned by dipping the broom in cold water, shaking off all the drops, and sweeping a yard or so at a time. Wash the broom and repeat until the entire carpet has been swept. 2. To take out grease spots, rub the spot with hard soap and wash out with a brush and cold water, and well dry each spot. To clean wall paper: 1. To remove stains or marks where people have rested their heads on wall papers, mix pipe clay with water to the consistency of cream, lay it on the spot, and allow it to remain till the following day, when it may be easily removed with a penknife or brush. 2. Cut off the crust of a loaf of bread and rub the wall with a lump of the bread; this will remove a great deal of the dirt.

(5125) A. E. writes: Kindly mention in your valuable paper what motor power will it require to run a wagon weighing about 400 pounds at the rate of one mile in three minutes? And also how many storage cells (same as described in SCIENTIFIC AMERICAN of March 4), plates size 10 inches × 10, shall I need for above motor? A. It will require three horse power for the 400 pounds wagon alone on a very smooth, level road. To this must be added the weight of the electric motor, storage batteries, and persons driving and riding in the vehicle. A motor for such a rig would weigh about 500 pounds, and the storage cells will weigh about 13 pounds each and require 60 in number, weighing 780 pounds, making the total load about 1,700 pounds. Total five horse power.

(5126) P. J. T. writes: 1. A friend claims the cable is not on the bottom of the ocean, but suspended in the water. He says that the undercurrent is so strong that it would not permit the cable to sink to the bottom. I say the cable is on the bottom, and that it was weighted at certain distances in order to sink it and steady it on the bottom, the weights being put on while the cable was rolled off. Please decide which is right. A. The cable rests on the bottom of the ocean for the greater portion of its length. It may in places be suspended by rocks above the bottom for short distances, but as a general thing it rests upon the ocean bottom. It does not require weights to sink it, as it is heavier than water. 2. I have a 8×10 photographic lens of 10 inch focus. Would it be possible to make the focus longer by getting a new tube and remounting it? Or is there any way of getting a larger picture of a distant object with same lens? A. You might be able to lengthen out the focus of your lens by placing behind it a concave lens of proper focal length. It might, however, interfere with the definition of the lens. 3. What part of the crankshaft of a steamship is the crankpin? A. The part which receives the connecting rod.

(5127) D. W. R. asks: 1. Why conductors on an electric light circuit burn when they some in contact. A. Because the resistance is great at the point of contact and the heat generated is sufficient to melt the wire; or, if the wires are separated, an electric arc is formed, which melts or burns the wires. 2. Can the "field" be unduly excited when the external resistance is low? A. No. 3. How is the regulation effected on a "compound" wound dynamo, and how does it differ from a "shunt" wound? A. It is regulated by the difference in current flowing in the shunt and series winding. 4. How should the lamps be connected? A. Arc lamps should be connected in series, incandescent lamps in parallel. 5. In what direction does a current flow in a dynamo, and how can I ascertain it? A. The positive brush of a dynamo is the one on the side of the commutator which moves toward the positive pole of the field magnet.

(5128) P. A. B. asks: What degree of heat would be produced by condensing the rays of the sun through a lens 3 feet in diameter to a focus 6 inches in diameter? What is the nature of the sun's heat that enables it to pass through clear ice or very cold glass without warming either? And why can we not increase the intensity of the heat from the rays of a very bright hot fire, electric or gas light by using a lens to gather and condense the rays? A. The loss of heat in passing through glass by reflection and absorption is considerable, and the loss by wave interference is still greater; so that the relative areas of lens and image is no criterion as to the amount of heat that may be developed or absorbed by a thermometer at the focus. The condition of the atmosphere is also a large factor, as everybody's experience shows. From 200° to 300° are possible, as you describe. The power of heat to pass through different transparent bodies is very variable. It being of a vibratory nature, the vibrations are retarded or absorbed in different proportions, according to the molecular condition of the bodies transmitting heat. Thus rock salt will transmit 92 per cent, glass 39 per cent, and ice only 6 per cent of heat rays. All bodies absorb more or less heat by transmission. All heat-giving sources can be intensified by condensation through lenses or by reflectors.

(5129) P. B. writes: Let a current of electricity be sent through a coil of wire. That will induce two currents in an adjacent coil—directand reverse. Then use this secondary coil as the primary coil to induce currents in a coil of wire adjacent to it. Would not four currents be induced in this last coil—two by the direct and two by the reverse? Continuing, and using this last coil as a primary, would not eight currents be induced? And so could not currents be multiplied in that manner until they became of the frequency of the vibrations of light? If it were possible to do this, by using fifty coils and breaking and making the first current in all twenty times per second, according to my calculations we would get 1,036,885,070,026,880 currents in the last coil. If this is not possible, why not? A. There is no reason why you could not produce alternating currents of very high frequency in the manner suggested; but unless you had a very large current to start with, a current from the 50th coil would be slight. The reversals of the current in the first coil would dominate all the currents in the other coils, so that you would have a period of the twentieth of a second in your last coil as in your first, so that the series of vibrations would be periodic.

(5130) E. H. J. asks: What is the highest degree of heat ever obtained by man? A. The highest temperature is obtained in the arc light, about 7,232° Fah.

(5131) R. A. C. writes: I want to build a small furnace for melting brass in small crucibles, 3¼ × 2½ inches. Can you please tell me the size to make the chimney and the size of grate surface? A. Any ordinary stove chimney, 8 × 8, will give sufficient draught. Fire-pot and grate, 10 inches diameter.

(5132) W. A. W. asks: 1. What diaphragm is the best for receiving sound waves? A. Edison, in his phonograph, uses a glass diaphragm one two-hundredth of an inch thick. 2. What material should I mix with wax to make it hard? A. The material of which the phonographcylinders are made is a secret. We do not think you can add anything to wax to make it serve a very good purpose as a phonographic cylinder. You might, however, try some paraffine. 3. How can I insert a needle in the middle of a watch glass? A. It is not easy to do this. You might insert a needle in a piece of metal or wood and cement it to the glass.

(5133) J. W. P. writes: I wish to use three-eighths copper wire for lightning rods, and want to know how to splice or join them. A. You can join the ends of your copper rods by using a brass or copper screw coupling, and to secure a more perfect electrical contact, the joint should be soldered.

(5134) J. J. F. asks: Would lead obtained by melting lead pipe and scraps of lead be suitable for making a storage battery? If so, how can I obtain a smooth sheet? How do you mix and apply litharge and red lead? Is any liquid used in so doing? A. The kind of lead to which you refer will answer for a storage battery, You can cast it in a metal mould. The litharge and red lead are to be mixed with a 10 per cent solution of sulphuric acid in water. You will find a simple storage battery described in "Experimental Science," also in the SCIENTIFIC AMERICAN, p. 134, vol. 68.

(5135) C. W. F. asks: What speed could I expect from a 2 horse power safety vapor engine in a boat 30 feet long by 5 feet, good modelfor speed? A. You may obtain about 4 miles per hour with your boat as stated.

(5136) C. K. W. asks: How many Leclanche cells will it take to explode the small platinum fuses, such as are used in blasting in quarries, that is to set off the powder or dynamite? Will it be necessary to introduce in the circuit a spark coil? If so, what number wire and what length will it take and how many Leclanche cells? A. Where platinum fuses are used a spark coil is not needed. If you are not too far from the blast, two cells would probably heat the platinum wire sufficiently to set off the blast.

© 1893 SCIENTIFIC AMERICAN, INC.

TO INVENTORS.

An experience of forty-four years, and the preparation of more than one hundred thousand applications for patents at home and abroad, enable us to understand the laws and practice on both continents, and to possess unequaled facilities for procuring patents everywhere. A synopsis of the patent laws of the United States and all foreign countries may be had on application, and persons contemplating the securing of patents, either at home or abroad, are invited to write to this office for prices which are low, in accordance with the times and our extensive facilities for conducting the business. Address MUNN & CO., office SCIENTIFIC AMERICAN, 361 Broadway, New York.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

May 30, 1893,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Aerating, cooling, and clarifying liquors, apparatus for, C. Rettig ... 498,571
Air brake coupling, J. Graham ... 498,705
Alarm. See Burglar alarm. Railway crossing alarm. Time alarm.
Autographic register and cash drawer, J. Pfeifer. 498,486
Autographic register and cash drawer, combined, J. Pfeifer ... 498,485
Axle box dust guard, J. Timms ... 498,369
Balloon, fire, T. M. Pierce ... 498,692
Banjo, H. E. Oakes ... 498,361
Banjo heads, device for stretching, A. J. Wilmshurst ... 498,345
Battery. See Galvanic battery.
Beacon or buoy, J. M. Foster ... 498,256
Bearing and hub, axle, W. D. T. Travis ... 498,589
Bearing, roller, B. Beaupre ... 498,737
Bearing, roller, E. H. Benners ... 498,228
Bed, extension wardrobe, L. Blumenthal ... 498,614
Bed, folding, S. Zimmermann ... 498,602
Bedstead, C. C. Lockstaedt ... 498,399
Bicycle, F. W. Huennekens ... 498,394
Bicycle stand, safety, C. J. Whipple ... 498,598
Bicycle umbrella attachment, H. E. Baskerville ... 498,224
Bicycle wheel, J. T. Oyler ... 498,688
Billet loop, L. G. Allen ... 498,221
Bin. See Flour bin.
Binder, H. N. Musser ... 498,481
Binder, R. R. Vernon ... 498,414
Bit. See Bridle bit.
Boat. See War boat.
Boat for transporting railway cars, A. McDougall 498,680
Boiler. See Multitubular boiler. Steam boiler. Tubular boiler. Vertical boiler. Wash boiler.
Boiler furnace, steam, E. M. Bosley ... 498,378
Boiler furnace, steam, J. & J. R. Scott ... 498,580
Boiler tube or flue beader, M. A. Lanagan ... 498,277
Boilers, automatic feeder for steam engine, J. N. Leach ... 498,397
Bone cutting machine, J. L. Lilley ... 498,398
Boring machine, A. J. & F. L. Kelchner ... 498,555
Bottle washer, C. Pease ... 498,725
Bottle washer, E. A. Wadsworth ... 498,371
Bottles, brush cleaning attachment for, C. Klein. 498,475
Box. See Musical box. Packing box. Snuff box.
Box lid support, V. MacVeagh ... 498,401
Bracket. See Roof bracket.
Brake. See Car brake. Vehicle brake.
Brick kiln. R. Garret ... 498,642
Bridge gate, E. C. Dittmann ... 498,463
Bridge post, J. B. Marsh ... 498,559
Bridle bit, D. H. Gillespie ... 498,644
Brush, paint, S. B. Hills ... 498,392
Brush, sewer cleaning, S. E. Johnston ... 498,659
Brush spoon, air, G. E. Bell ... 498,227
Burglar alarm, C. H. Dedrick ... 498,708
Burial apparatus, J. C. Stevens ... 498,319
Burial case, Georgeson & Konrad ... 498,511
Burner. See Hydrocarbon burner. Oil burner.
Butter extractor, centrifugal, T. T. A. Hansen ... 498,470
Button, M. F. Godfrey ... 498,712
Button machine, Strauss & Ripp ... 498,411
Cable grip, J. Kratz ... 498,517
Cam gear, rotary, C. W. & W. F. Hunt ... 498,552
Can floating pots, supporting attachment for, J. B. Holsten ... 498,653
Can opener, W. Yerdon ... 498,346
Can testing machine, G. Roth ... 498,408
Cane and chair, combined walking, M. A. Wilcox. 498,453
Car brake, Maechling & Porter ... 498,356
Car brake, electric, N. J. Clute ... 498,624
Car coupling, H. C. Buhoup ... 498,381
Car coupling, Clark & Turnbull ... 498,621
Car coupling, Conrad & Winter ... 498,625
Car coupling, M. Cundiff ... 498,242
Car coupling, W. R. Jenkins ... 498,473
Car coupling, C. O. Myers ... 498,675
Car coupling, F. M. Ryan ... 498,575
Car coupling, J. G. Williams ... 498,343
Car draw bar, G. W. Tompkins ... 498,329
Car draw bar, street, J. A. Trimble ... 498,334
Car fender, safety, G. Latz ... 498,556
Car mover, F. Mertsheimer ... 498,521
Car, railway freight, Caverno & Fowler ... 498,234
Car sanding attachment, street, T. B. Clark ... 498,706
Car sanding device, street, E. F. De Witt ... 498,632
Car stopping and derailing device, Bates & Carter 498,611
Car street, J. A. Trimble ... 498,333
Car transportation carriage, A. Bowie ... 498,739
Car trolley, electric, R. D. Nuttall ... 498,722
Car, ventilated fruit and refrigerator, H. A. Smith ... 498,449
Car vestibule, L. J. Harris ... 498,432
Cars, coupling for steam pipes of railway, J. E. Marble ... 498,520
Cars, valve for steam pipes of railway, E. E. Gold 498,545
Carbureting apparatus, air, O. Mulvey ... 498,673
Carburetor, R. J. Rolfson ... 498,447
Carpet sweeper, C. A. Hammett ... 498,431
Carriage, baby, W. A. Marqua ... 498,440
Cart, road, G. J. Overshiner ... 498,687
Case. See Burial case. Toilet powder case.
Cash recorder and indicator, W. H. Cleasby ... 498,532
Cash register, E. B. Hess ... 498,716
Cash register, indicator, recorder, and check printer, G. Boemerman ... 498,615
Cash registering machine, Range & Foote ... 498,728
Casket handle, L. H. Banuister ... 498,610
Caster, S. Hoobler ... 498,271
Caster, furniture, O. Pederson ... 498,297
Caster socket, H. H. McIlhiney ... 498,444
Cesspool, M. Moriarity ... 498,287
Chain link, drive, J. S. Carter ... 498,233
Chair. See Window washing chair.
Chairs, fan attachment for rocking, M. M. Ruth ... 498,365
Check hook, R. N. Martz ... 498,281
Check row attachment, M. C. McMillan ... 498,292
Checkrein detaching or attaching device, H. P. Kyes ... 498,353
Chimney attachment, R. B. Holmes ... 498,393
Churn, J. F. Allison ... 498,499
Chute, coal, H. A. Ainsworth ... 498,419
Cigar head forming device, C. W. Boman ... 498,738
Clamp. See Saw clamp.
Cleaner. See Dish cleaner. Railway track cleaner.
Clip or fastening, Evans & Davies ... 498,509
Clock, electric alarm, W. M. Fowler ... 498,468
Clutch, friction, G. Philion ... 498,300
Cock for water coolers, J. H. Savill ... 498,366
Coffee roaster, Petway & Mullins ... 498,299
Coffin fastener, C. O. Phillips ... 498,301
Coffin fastener, F. C. Riddle ... 498,525
Collar and necktie fastener, C. P. Ware ... 498,592
Conduit joint with switch and cut-off valve, T. Lee ... 498,558
Conduits, clearer for slotted, J. C. Love ... 498,437
Cooking canned goods, means for, Merrill & Lovell ... 498,358
Copybook, penmanship, A. J. Creamer ... 498,628
Copying and recording apparatus, autographic, L. E. Levassor ... 498,436
Corer and slicer, apple, F. W. Winckler ... 498,528
Coupling. See Air brake coupling. Carcoupling. Link and pin coupling. Thill coupling. Vehicle reach coupling.
Cracker machine, Fowler & Rockwell ... 498,641
Crane, L. Atwood ... 498,605
Crusher. See Ore crusher.
Cultivator, G. K. Jackson ... 498,656
Cultivator, J. F. Packer ... 498,294
Cultivator, beet, G. G. Crowley ... 498,241
Curtains and blinds, adjustable stand for, L. Beer ... 498,226
Cut-off, rain water, M. A. Laska ... 498,663
Cut-out, electric, W. P. Mashinter ... 498,560
Cutlery, table, A. W. Cox ... 498,627
Cutter. See Rotary cutter.
Cylinders, mechanism for operating intermittently revolving, G. F. McIndoe ... 498,445
Damper controlling mechanism for heating apparatus, E. Fales ... 498,251
Dental broach, O. Johanson ... 498,554
Desk, school, G. A. Bobrick ... 498,703
Dice machine, coin-controlled, W. R. Pope ... 498,363
Die plate, L. C. Wetzel ... 498,595
Digger. See Potato digger.
Dish cleaner, O. O. Hodgon ... 498,549
Displaying boots or shoes, device for, C. F. Porter ... 498,694
Door check and lock, J. J. Ridgway ... 498,491
Door hanger, H. L. Ferris ... 498,467
Door, screen, A. Drummond ... 498,508
Doors, windows, etc., guard for, L. F. Ryan ... 498,574
Dough dividing machine, H. Unzicker ... 498,590
Draught device, spring, J. E. Norwood ... 498,684
Dramatic effects, apparatus for producing illusory, W. H. Lytell ... 498,668, 498,669
Drilling machine, T. C. Sime ... 498,313
Dust separator, T. Lee ... 498,557
Dye, disazo, P. Ott ... 498,405
Dye, glycine, E. Von Portheim ... 498,303
Dye, greenish-blue, P. Ott ... 498,404
Dye, triphenyl methane, H. Hassencamp ... 498,471
Easel, M. Schmirk ... 498,578
Educational cabinet, C. L. Ellis ... 498,636
Eggs, extracting the contents of, M. J. Power ... 498,488
Electric fixtures, junction block for, F. A. Dugan ... 498,539
Electric generator or motor, C. E. Dressler ... 498,538
Electric lighting system, C. E. Scribner ... 498,312
Electric machine, dynamo, C. E. Dressler ... 498,537
Electric machines, pole piece for dynamo, E. Thomson ... 498,327
Elevator. See Hay elevator.
Elevator framework, T. F. Sanford ... 498,576
Elevators, cable fastening apparatus for hydraulic, W. H. Hultgren ... 498,434
Embalming, antiseptic fluid for, M. Huncke ... 498,350
Emery wheels, tool for dressing, W. P. Alger ... 498,220
Engine. See Gas engine. Rotary engine. Steam engine.
Engine regulator, steam, F. W. Mount ... 498,672
Engine safety stop, W. H. Towle ... 498,330
Engines, starting appliance for compound, Heintzelman & Noyes ... 498,650
Excavator, M. E. Pugh ... 498,364
Extension table, W. Blankner ... 498,230
Extension table, W. C. Steers ... 498,318
Extractor. See Butter extractor.
Fabric trimming and sewing machine, Borton & Willcox ... 498,616
Fabrics, method of and mechanism for uniting, S. Borton ... 498,617
Fan, electric rotary, J. F. Denison ... 498,462
Fans, etc., driving mechanism for, J. J. Harrity, Jr ... 498,389
Fans, system of, W. F. Healy ... 498,547
Faucet attachment, beer, T. H. Mehring ... 498,357
Fence machine, wire and picket, Reniff & Tucker 498,306
Fence, wire, M. J. Page ... 498,296
Fences, machine for weaving cross wires in, H. Carter ... 498,459
Fender. See Car fender.
File case binder, A. Dom ... 498,744
File, paper, A. J. Delp ... 498,349
File, pattern, R. J. Ewig ... 498,541
Filing cabinet, R. Miller ... 498,283
Filter, C. C. Froelich *et al* ... 498,544
Filter, E. M. Knight ... 498,276
Filter, A. D. Strong ... 498,586
Finger ring, convertible, L. Gumbart ... 498,648
Fire alarm system, J. Sachs ... 498,448
Fire extinguisher for cotton gins, E. Northcraft ... 498,683
Fire sprinkler, automatic, C. W. Kersteter ... 498,661
Flanging machine, F. Hart ... 498,433
Flask holder, metallic, J. W. Rhodes ... 498,406
Floor, G. W. Williams ... 498,344
Flour bin, C. Tangenberg ... 498,526
Flour bin and sifter, combined, M. F. Brown ... 498,232
Fluid meters, actuating mechanism for, F. W. Skinner ... 498,314
Friezer machine hand guard, M. Henry ... 498,263
Fruit gatherer and pruning implement, S. Chambers ... 498,620
Fruit picker, A. C. Hedden ... 498,715
Fuel, Cronin & Edwards ... 498,629
Furnace. See Boiler furnace. Glass melting furnace. Glass or other furnace. Hot air furnace. Hot water furnace. Smelting furnace.
Furnace door operating apparatus, O. H. Clark ... 498,507
Furnace regulator, G. E. Dixon ... 498,535
Furnaces, automatic stock indicator for blast, McClure & Phillips ... 498,676
Furnaces, fire door for downdraught, Galbraith & Taylor ... 498,258
Furnaces, water-back for straw burning, C. Nye ... 498,686
Fuse holder, revolving, C. H. Ruggles ... 498,698
Gauges, etc., stock for surface, C. W. Preston ... 498,726
Galvanic battery, W. Burnley ... 498,422
Galvanic battery and electrical toy instrument, W. A. Connelly ... 498,743
Game, A. M. Watson ... 498,702
Game apparatus, F. J. Secker ... 498,367
Game apparatus, G. E. Sovereign ... 498,451
Garment supporter, R. S. Willard ... 498,527
Gas engine, S. Lawson ... 498,476
Gas engine, C. V. Walls ... 498,700
Gas generator, and burner for heating purposes, petroleum, T. A. Stombs ... 498,410
Gas governor, A. Ford ... 498,543
Gas lighting or extinguishing apparatus, J. Sangster ... 498,492
Gas pressure regulator, safety, J. Fleischer ... 498,253
Gas producer feed device, C. W. Bildt ... 498,229
Gate. See Bridge gate. Railway gate. Road gate.
Gear cutting machine, A. Mertes ... 498,720
Generator. See Electric generator. Gas generator. Hydrocarbon generator. Steam generator.
Glass or other furnace, W. H. Forbes ... 498,640
Glue pot, F. Kahrs ... 498,717
Glue to paper, machine for transferring, A. Becker ... 498,502
Grain huller, scourer, and polisher, combined, B. E. Fischer ... 498,510
Grain separator, H. Hamper ... 498,388
Grinding machine, reamer, R. Conrader ... 498,240
Grindstone attachment, J. M. Clock ... 498,623
Grindstone casing or trough, C. Graf-Link ... 498,647
Gun, breakdown, A. Fyrberg ... 498,427
Guns on ships, means for handling and firing, A. McDougall ... 498,678
Gutter, hanging, C. C. Moore ... 498,286
Gymnastic apparatus, T. Bessing ... 498,376
Gynecological wall table, E. J. Noblett ... 498,293
Hame bending machine, A. W. Freeman ... 498,469
Hammer, power, D. Longworth ... 498,354
Hammer, power, F. Ryman ... 498,752
Hammock, C. A. De Laney ... 498,245
Hammock spreaders, manufacture of, E. T. Fellowes ... 498,542
Handle. See Casket handle. Saw handle. Tool handle.
Harness, J. H. Gibson ... 498,836
Harrow, J. F. Packer ... 498,295
Harrow and pulverizer, combined, H. James ... 498,273
Harrow disk, A. J. Glass ... 498,428
Harvester, corn, Brown & Solt ... 498,409
Harvester, corn, J. F. Steward ... 498,320
Harvester, corn or cane, H. Poole ... 498,693
Hasp lock, Buckingham & McCrory ... 498,457
Hay carrier, W. Louden ... 498,748
Hay elevator, W. Louden ... 498,666
Headlight, J. F. Murphy ... 498,443
Heater. See Water heater.
Heater, G. E. Dixon ... 498,536
Heating, illuminating, or culinary purposes, appliance for, F. E. Browne ... 498,380
Hedge trimmer, E. C. & A. M. Gordon ... 498,713
Heeling machine, C. W. Glidden ... 498,513
Hinge for desks, stop, T. Morris ... 498,564
Hitching device, F. G. Milbrath ... 498,562
Hook. See Check hook. Straw or hay hook.
Hook, E. Dederick ... 498,630
Horse boot, F. C. Pooler ... 498,302
Horse canopy, W. H. Smawley *et al* ... 498,583
Horse detacher, J. E. Norwood ... 498,685
Horse detacher, D. K. Stone ... 498,322
Horse detaching device, Kirkscey & Bowden ... 498,395
Horse hitching device, C. Kasper ... 498,351
Hot air furnace, F. G. Ward ... 498,701
Hot water furnace, T. Brooks ... 498,531
Hydrocarbon burner, W. A. Minteer ... 498,671
Hydrocarbon generator and burner, combined, F. M. Reed ... 498,130
Index, telephone, F. S. Blanchard ... 498,503
Indicator. See Speed indicator. Station indicator. Street or station indicator.
Insulated binding post, R. H. Rich ... 498,407
Iron. See Sad iron. Soldering iron.
Jack. See Lifting jack.
Joint. See Conduit joint.
Journal bearing dust guard, B. Beaupre ... 498,736
Kiln. See Brick kiln.
Knob attachment, W. E. Deibert ... 498,244
Lamp, electric arc, H. Alexander ... 498,604
Lamp, electric arc, F. D. Goold ... 498,387
Lamp, electric arc, L. Hills ... 498,269
Lamp, electric arc, P. Nordmann ... 498,566
Lamp sockets, adapter for, H. P. Ball ... 498,374
Lamp suspension device, electric, J. J. Renehan ... 498,570
Land roller, G. A. Farrall ... 498,252
Lantern, F. K. Wright ... 498,416
Lantern, tubular, L. F. Betts ... 498,420
Last, G. H. Clark ... 498,237, 498,238
Last, G. Meermann ... 498,478
Latch, F. W. Tobey ... 498,413
Lathe index dividing attachment, F. Wilkie ... 498,497
Leggin, B. Lyons ... 498,279
Letter, sign, F. L. Gregory ... 498,430
Lid holder, C. J. Peterson ... 498,569
Lifter. See Wagon body lifter.
Lifting jack, J. B. Delong ... 498,246
Lifting jack, automatic, J. C. Hackett ... 498,546
Link and pin coupling, T. Gaskins ... 498,643
Lock. See Hasp lock. Oar lock.
Lock, J. J. Ridgway ... 498,490
Locomotive, electric, A. Schmid ... 498,577
Log pulling apparatus, E. M. Ivens ... 498,655
Loom harness hook, J. Johnson ... 498,474
Loom picker check, W. Kershaw ... 498,515
Loom shuttle box operating mechanism, G. Goodline ... 498,260
Loom shuttle box operating mechanism, H. Wyman ... 498,417
Loom take-up mechanism, H. Wyman ... 498,418
Lubrication system, A. C. Pain ... 498,689
Lubricator, E. H. Lunken ... 498,438
Mail receptacle, A. Holtum ... 498,550
Match safe, N. O. Bond ... 498,377
Metal bar shearing machine, W. Raymond ... 498,729
Metal chests, manufacture of, F. J. King ... 498,718
Milk or cream and producing butter, apparatus for treating, G. W. Grader ... 498,646
Milk or cream purifying apparatus, G. W. Grader 498,645
Mill. See Windmill.
Monument, cast metal, J. M. Cameron ... 498,506
Motions, means for giving reciprocating or other, H. S. McKay ... 498,721
Motor. See Rotary motor.
Mower, lawn, L. Clousing ... 498,533
Multitubular boiler, A. Coignet ... 498,239
Musical box, O. P. Lochmann ... 498,278
Musical instruments, automatic cut-off for, C. Riegger ... 498,573
Nail assorting machine, C. W. Glidden ... 498,429
Nail or staple, J. E. Leathers ... 498,664
Nozzle, spray, A. W. White ... 498,599
Nut lock, H. W. Armstrong ... 498,734
Nut lock, M. F. Deininger ... 498,631
Nut lock, W. J. Jones ... 498,660
Nut lock, S. G. Read ... 498,446
Nut lock, E. Stillwell ... 498,368
Nut lock, W. C. Woods ... 498,601
Oar lock, L. Gerhardt ... 498,512
Oil burner, Vollmer & Campbell ... 498,591
Oil, treating, C. Toppan ... 498,588
Oleine or stearine from suet, process of and apparatus for separating, Benoit & Soler y Vila ... 498,375
Optical illusions, device for producing, G. V. Palm ... 498,524
Orange wrapping machine, A. Ayer ... 498,222
Ore crusher, U. Cummings ... 498,424
Organ action, pneumatic, J. V. Pilcher ... 498,362
Oven, baker's, J. Vicars *et al* ... 498,335
Oven, baking, D. Grove ... 498,261
Package register, J. R. Fletcher ... 498,254
Packing box for jars, bottles, etc., S. E. Parrish *et al* ... 498,567
Paper roll holder and changeable type printer, F. B. Kosa ... 498,516
Pen, F. J. W. Fischer ... 498,746
Pen, electric perforating, Lewis & Witherell ... 498,519
Pen, fountain, G. A. Hall ... 498,514
Penholder, I. Thompson ... 498,495
Pencil holder, J. Matsuo ... 498,442
Piano mute, J. A. Kieselhorst ... 498,352
Pianoforte action, A. F. S. & H. G. Osterberg ... 498,523
Picker. See Fruit picker.
Pile driver, H. C. Sergeant ... 498,493
Pinch bar, J. McDonald ... 498,677
Pipes, car axles, etc., tool for turning, G. Englund ... 498,638
Plaiting machine, C. C. Emmons ... 498,637
Planter seed dropping machanism, corn, L. Z. Preston ... 498,727
Plow and cultivator, combined gang, M. A. Randolph *et al* ... 498,697
Plow, gang, J. S. Butler ... 498,741
Plow, wheel, W. L. Casaday ... 498,704
Pneumatic tool, J. G. Carlinet ... 498,742
Pole, carriage, J. Shand ... 498,581
Pole tip, J. O. Hebert ... 498,548
Polycycle, Noonan & Schmill ... 498,484
Post. See Bridge post.
Pot. See Glue pot.
Potato digger, A. Olmsted ... 498,522
Printing machine, bed and cylinder, S. W. Brainerd *et al* ... 498,530
Printing, photomechanical, W. Kurtz ... 498,396
Propulsion for steamships, water jet, F. W. Richardson ... 498,572
Pulley, expansion, Black & Carey ... 498,613
Punch, ticket, J. Gillespie ... 498,259
Puzzle, J. C. Field ... 498,639
Pyralin, machine for cutting sheets or films of, J. R. France ... 498,257
Railway, T. James ... 498,274
Railway block signaling system, A. S. McCaskey ... 498,290
Railway crossing, H. O'Shea ... 498,724
Railway crossing alarm, Tinsman & Goold ... 498,587
Railway gate, C. K. Stearns ... 498,452
Railway gripper, cable, P. T. Taylor ... 498,325
Railway switch mechanism, W. J. Ward ... 498,337
Railway track, J. Wallace ... 498,336
Railway track cleaner, street, Clark & Ogren ... 498,622
Railway trolley, electric, R. M. Hunter ... 498,435
Railway trolley, electric, R. D. Nuttall ... 498,723
Railway trolley, electric, P. F. O'Shaughnessy ... 498,403
Railways, system for supplying currents to electric, C. Zipernowsky ... 498,603
Range, N. J. Periolat ... 498,298
Razor stropping or honing machine, J. A. Knight 498,662
Reaper, O. O. Storle ... 498,323
Recorder. See Cash recorder.
Refrigerator, H. C. Beardsley ... 498,612
Refrigerator, C. C. Lockstaedt ... 498,400
Refrigerator drip cup attachment, C. T. Ranney ... 498,489
Register. See Autographic register, Cash register.
Registering device, electric, B. B. Ward ... 498,372
Regulator. See Engine regulator. Furnace regulator. Gas pressure regulator.
Regulator, P. La Cour ... 498,461
Ring. See Finger ring.
Rivet setting machine, H. H. Cummings ... 498,423
Road gate, J. H. Williams ... 498,596
Roaster. See Coffee roaster.
Roller. See Land roller.
Roller for crushing ore or other material, T. A. Edison ... 498,385
Roof bracket, T. H. Moore ... 498,285
Rotary cutter, H. P. Fairfield ... 498,745
Rotary engine, A. Boyd ... 498,618
Rotary motor, electrical, W. J. Still ... 498,585
Sad iron, Tullis & Cox ... 498,370
Salt drier, centrifugal, J. M. Duncan ... 498,383
Sash frame, dustproof, J. H. M. Beaty ... 498,225
Sausage stuffer, J. B. Spatz ... 498,317
Saw attachment, gang, J. Weingartner ... 498,594
Saw clamp, M. D. Miner ... 498,360
Saw handle, M. M. Cope ... 498,626
Scaffold horse, F. C. Lovejoy ... 498,749
Scale, spring, E. N. Gilfillan ... 498,711
Screw threads, die for forming, J. Sheldon ... 498,582
Seam for articles of manufacture, C. H. Wilcox ... 498,600
Self-waiting table, J. Hammerle ... 498,747
Separator. See Dust separator. Grain separator.
Separator, F. H. Wheelan ... 498,597
Sewing machine, W. H. H. Tracy ... 498,331, 498,332
Sewing machine, wax thread, O. E. Brown ... 498,505
Shade cloth stretching and drying machine, W. Bailey ... 498,609
Shaping machine, W. L. Vanderploeg ... 498,733
Shoe fastening, T. Schneider ... 498,579
Shutter, flexible, H. N. H. Lugrin ... 498,477
Signaling apparatus, train, H. R. Mason (r) ... 11,343
Signaling system, electrical, A. S. McCaskey ... 498,289
Skipping rope, L. B. Tucker ... 498,753
Slates, noiseless attachment for school, G. H. Bartlett ... 498,456
Smelting furnace, steel, M. Mannaberg ... 498,670
Smoke consuming furnace, P. Mohler ... 498,284
Snuff box, C. L. Powell ... 498,695
Soldering iron can, Merrill & Lovell ... 498,359
Sole leveling machine, Bresnahan & Heys ... 498,619
Spectacle bow wire or other articles, means for forming, F. Ecaubert ... 498,466
Speculum, H. Dickinson, Jr ... 498,633
Speed indicator, J. M. Napier ... 498,483
Spinning frames, separator mechanism for ring, C. L. Hildreth *et al* ... 498,264
Spinning frames, separator mechanism for ring, C. L. Hildreth ... 498,265 to 498,268
Spinning frames, separator mechanism for ring, C. F. Randall ... 498,305
Spinning frames, separator mechanism for ring, C. Whitaker ... 498,338, to 498,342
Spoke holder, F. M. Lewis ... 498,719
Sprayer, A. G. Provine ... 498,696
Spring. See Vehicle spring.
Sprinkler. See Fire sprinkler.
Station indicator, M. Manuel ... 498,280
Steam boiler, G. Durr ... 498,465
Steam boiler, E. F. Edgar ... 498,384
Steam boiler and furnace, C. R. & G. A Ayer ... 498,500, 498,501, 498,606
Steam engine, J. Dow ... 498,734
Steam generator, J. Hunter ... 498,272
Steam generator, C. H. Shaw ... 498,699
Steamer and drier, grain, G. Y. Smith ... 498,731
Steel, etc., composition for supercarburizing, H. A. Harvey ... 498,390
Steel shaping apparatus, J. A. Potter ... 498,304
Stool, cane, E. C. Phillips ... 498,487
Stove, air heating, L. P. Converse ... 498,460
Stoves, ranges, etc., grate for, J. Tettelbach ... 498,326
Stovepipe, W. E. Smith ... 498,316
Stovepipe attachment, F. Schmidt ... 498,310
Straw or hay hook, K. S. Hawk ... 498,391
Street or station indicators, operating, R. B. Ayres ... 498,607
Street sweeping machine, T. J. McArthur ... 498,402
Studs, manufacture of facing, S. N. Smith ... 498,315
Sulky, S. Elliott ... 498,709
Switch. See Telephone switch.
Table. See Extension table. Gynecological wall table. Self-waiting table.
Tank. See Water tank.
Tap, beer, H. F. Jacoby ... 498,657
Telegraph printing, E. V. Baillard ... 498,529
Telegraph, printing, D. Murray ... 498,674
Telephone exchange system, automatic, A. S. McCaskey ... 498,291
Telephone switch, A. G. Davis ... 498,243
Telephone system, E. A. Clark ... 498,236
Telephone transmitter, C. F. Scattergood ... 498,309
Tether, G. Meyer ... 498,282
Thermometer, J. J. Hicks ... 498,651
Thill coupling, N. A. Swett ... 498,732
Time alarm, electric, C. S. Gibson ... 498,710
Tire tightener, C. Vantrees ... 498,415
Tire, wheel, H. A. Lozier ... 498,667
Tobacco cutting machine, J. B. Adt ... 498,454
Toilet powder case, C. P. Thomas ... 498,412
Tongs, H. Aiken ... 498,498
Tool handle, W. S. Eaton ... 498,247
Tool holding box, G. H. Bartlett ... 498,455
Toy kite, E. S. Boynton ... 498,379
Track scraper, E. J. Emerson ... 498,249
Transom pivot, H. Howarth ... 498,551
Tree transplanting device, D. W. Aylworth ... 498,608
Tricycle, H. Matzen ... 498,750
Trimmer. See Hedge trimmer.
Trolley catcher, C. A. Lord ... 498,355
Trunk catch, O. D. Hunter ... 498,472
Trunks on stairs, device for facilitating moving, W. H. H. Hallock ... 498,649
Tubing metal, J. Callan ... 498,458
Tubular boiler, circulating, E. L. Martin ... 498,441
Tunnel warning device, safety, G. W. Thompson. 498,328
Turpentine tool, W. Watson ... 498,593
Tuyere, J. McClelland ... 498,565
Type matrices, spacer for, J. C. Fowler ... 498,425, 498,426
Type wheels, mould for the formation of, Eckert & Bergmann ... 498,248
Type writing machine, W. A. Phillips ... 498,691
Umbrella, self-opening, J. T. & F. S. Liley ... 498,665
Valve, E. H. Lunken ... 498,439
Valve, automatic air, C. Jenkins ... 498,275
Valve controlling mechanism, W. P. Ogden ... 498,751
Valve, globe, J. Wilkes ... 498,496
Valve operating mechanism, Parish & Meyer ... 498,690
Valve, pressure regulating, J. Nageldinger ... 498,482
Valve, steam engine, J. Dow ... 498,655
Vaporizing oil, apparatus for, R. H. Laird ... 498,518
Vegetable reducer, J. G. Hemesath ... 498,202
Vehicle brake, G. H. Zeigler ... 498,347
Vehicle reach coupling, C. C. Bradley ... 498,421
Vehicle spring, J. M. Holler ... 498,270
Vehicle wheel, A. S. Flint ... 498,254
Vehicle wheel, M. F. Meisch ... 498,479
Vehicle wheel, G. R. Williams ... 498,378
Vertical boiler, G. Y. Smith ... 498,450
Vessel, A. McDougall ... 498,681
Vessel, war, A. McDougall ... 498,682
Vessels, copper coating the hulls of, T. S. Crane ... 498,707
Vise, bench, J. E. Mulford ... 498,288
Wagon, A. Jennings ... 498,553
Wagon body lifter, J. W. Chambers ... 498,235
Wagon dumping, J. Blum ... 498,504
Wagon dumping, M. W. Montgomery ... 498,480
Wagon, vending, M. Brazeau ... 498,231
Walls of frame houses, stop for, E. F. Montgillion 498,563
War boat, A. McDougall ... 498,679
Wash boiler, H. D. Jeffrey ... 498,658
Washer. See Bottle washer.
Washing machine, G. E. Bartholomew ... 498,223
Washing machine, W. Hilton ... 498,652
Washing machine, W. Sweet ... 498,324
Watch chain attachment, J. V. Hussey ... 498,654
Watch, stem winding and setting, F. Terstegen ... 498,494
Watchcase backs, die for, F. Ecaubert ... 498,540
Water heater and condenser, J. E. Crawley ... 498,534
Water tank, Pennell & Sullivan ... 498,568
Waterwheels, apparatus for regulating the speed of, C. Hagmaier ... 498,714
Weeding machine, L. Schnackenburg ... 498,611
Welding apparatus, electric, J. H. Bassler ... 498,735
Wheel. See Bicycle wheel. Vehicle wheel.
Wheel, L. J. Crecelius (r) ... 11,342
Windlass gear, Bryant & Victor ... 498,740
Windmill, G. B. Snow ... 498,584
Window, M. Classen ... 498,382
Window washing chair, A. Dormitzer ... 498,464
Wire, device for winding loose, N. Rule ... 498,307
Wool, etc., apparatus for treating and scouring, etc., Eyre & Hopkins ... 498,250
Wool washing machine, F. G. & A. C. Sargent ... 498,308
Wrench, A. Anderson ... 498,348
Wrench, C. Stolze ... 498,321
Zither attachment, T. Meinhold ... 498,561

TRADE MARKS.

Ales, porters, and beers, S. Liebmann's Sons Brewing Company ... 23,139
Beer and ale, Wm. J. Lemp Brewing Company ... 23,134, 23,135
Bicycles and sulkies, Central Cycle Manufacturing Company ... 23,162
Blacking and burnishing compounds for boots and shoes, W. R. Albertson ... 23,143
Boots and shoes, W. H. Fearey ... 23,113 to 23,116
Bottles and valves, glass, Whitney Glass Works ... 23,156
Brandy, Wm. Bergenthal Company ... 23,138
Calisaya, preparation of, C. A. Reed ... 23,155
Canned vegetables and fruits, B. S. Janney & Co ... 23,130
Cereal products, certain named, Seeman Brothers 23,126
Cigarettes, J. Lhowe ... 23,132
Cloths for outer garments, woolen, worsted, and cotton, B. W. Greer ... 23,121, 23,122
Composition for cleaning fabrics and for household use, powdered, Progressive Product Company ... 23,142
Cooking utensils and other enameled domestic ware, enameled, Schweimer Emaillirwerk Braselmann, Puttmann & Co ... 23,157
Corsets for ladies, C. L. Olmstead ... 23,112
Cures, headache, E. A. Butts ... 23,147
Cutlery, Sperry & Alexander ... 23,158
Fire hose and woven fabric of which it is composed, New York Belting and Packing Company ... 23,124
Flour, B. S. Rembaugh ... 23,128
Food for infants and invalids, Harvard Baby Food Co ... 23,125
Lard, North Packing and Provision Company ... 23,131
Leads, tinted, Wadsworth, Howland & Company ... 23,110
Leather, E. H. Dewson & Son ... 23,123
Lotion for external use as a cosmetic, dentifrice, hair tonic, and remedy for skin diseases, etc., Athlophoros Company ... 23,146
Medicinal plasters, Athlophoros Company ... 23,145
Mineral water, natural, Victoria Mineral Water Spring Company ... 23,136, 23,137
Mordants for use in dyeing fibers and fabrics, cleansing, Nashoba Manufacturing Company ... 23,141
Nails, wire, McKay Metallic Fastening Association ... 23,159
Plasters, Firm of E. J. Weiser ... 23,144
Remedies, catarrh, J. B. Pitt ... 23,148
Remedy for certain named diseases, F. M. Criswell 23,154
Remedy for diseases of the blood, kidneys, liver, stomach and bowels, C. S. Mick ... 23,152
Remedy for diseases of the stomach, blood, and liver, and cure for bites, stings, burns and sprains, internal and external, E. J. Fountain ... 23,153
Remedy for diseases of the throat, lungs, and mucous membrane, sirup, H. G. Harter ... 23,149
Remedies for diseases peculiar to women, North Chemical Company ... 23,150
Sewingmachines, Standard Sewing Machine Company ... 23,160
Sewing machine and attachments, American Buttonhole Overseaming and Sewing Machine Company ... 23,161
Shirt waists, blouses, ladies' wrappers, and gowns, D. Levy & Sons ... 23,111
Silks, Whitney & Co ... 23,120
Soap, Enterprise Soap Works ... 23,140
Specifics, syphilitic, W. T. Batterson ... 23,151
Spices, ground or powdered, Gilpin, Langdon & Co. 23,129
Tobacco, cigars, and cigarettes, cheroots, and snuff, American Tobacco Company ... 23,133
Wheat and oats for table use, prepared, D. W. Young ... 23,127
Yarns and threads, J. R. Leeson & Co ... 23,117 to 23,119

DESIGNS.

Axle box frame, J. A. Brill ... 22,490
Book mark, W. F. Clowes ... 22,481
Card, memorial, J. G. Henderson ... 22,477

© 1893 SCIENTIFIC AMERICAN, INC.

Carpet, E. Fisher	22,475
Carpet, W. L. Jacobs	22,473
Carpet, C. W. Swapp	22,474
Cigar and match case, R. J. Panduro	22,488
Cutlery handle, C. F. Mosman	22,484
Cutlery handle, C. F. Smith	22,483
Knife blade, C. F. Smith	22,482
Metal border, W. H. Tomey	22,485
Monument, H. T. Clawson	22,476
Nozzle for lawn sprinklers, J. H. Melavin	22,491
Oil can, P. & A. Good	22,489
Pepper or salt box, J. Walter	22,486, 22,487
Puzzle, W. S. Bates	22,479
Radiator, J. E. Bidwell	22,493
Rug, A. Petzold	22,472
Spoon, G. E. Homer	22,480
Trucks, upper chord for car, J. A. Brill	22,492
Type, font of printing, R. S. Avery	22,478

A printed copy of the specification and drawing of any patent in the foregoing list, or any patent in print issued since 1863, will be furnished from this office for 25 cents. In ordering please state the name and number of the patent desired, and remit to Munn & Co., 361 Broadway, New York.

Canadian patents may now be obtained by the inventors for any of the inventions named in the foregoing list, provided they are simple, at a cost of $40 each. If complicated the cost will be a little more. For full instructions address Munn & Co., 361 Broadway, New York. Other foreign patents may also be obtained.

Advertisements.

ORDINARY RATES.

Inside Page, each insertion - - 75 cents a line

Back Page, each insertion - - - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

"Star" Foot Lathe Swings 9x25 in.

LATHE

Screw Cutting Automatic Cross Feed, etc.

Scroll Saws, Circular Saws, Lathes Mortisers.

Catalogue Free of all our Machinery.

Seneca Falls Mfg. Co., 695 Water St., Seneca Falls, N.Y.

IMPROVED ENGINE LATHES MODERN DESIGNS

Also Foot Lathes, Tools and Supplies. Catalogue Free

Sebastian Lathe Co. 120-122 Culvert Street CINCINNATI, OHIO.

212° FAHR THE STEAM JACKET

FEED WATER BOILER & PURIFIER

BOILS THE WATER

Wm BARAGWANATH & SON

46 W. DIVISION ST.

SEND FOR CATALOGUE. CHICAGO.

$10.00 to $50.00 per night. A light and profitable business. Magic Lanterns and Views of popular subjects. Catalogues on application. Part 1 Optical, 2 Mathematical, 3 Meteorological, 4 Magic Lanterns, etc. L. MANASSE, 88 Madison Street, Chicago, Ill.

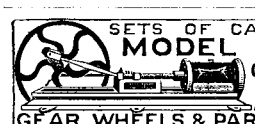
KING OF THEM ALL.

24 Page Catalogue Free. Agents Wanted.

MONARCH CYCLE CO.

Lake and Halstead Sts., CHICAGO, U. S. A.

ICE-HOUSE AND COLD ROOM.—BY R. G. Hatfield. With directions for construction. Four engravings. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 59. Price 10 cents. To be had at this office and from all newsdealers.



SETS OF CASTINGS OF MODEL ENGINES CATALOGUES FREE. ALSO TOOLS, GEAR WHEELS & PARTS OF MODELS

GOODNOW & WIGHTMAN BOSTON

Inventions and Novelties Developed.

Manufacturers of Electrical Goods. Experimental and Repair Work. THE N. Y. ELECTRICAL AND DEVELOPMENT CO., 251 William Street, New York.

CALDWELL IMPROVED CHARTER GAS ENGINES.

2 TO 50 ACTUAL H.P.

USING GASOLINE, COAL GAS, NATURAL GAS OR PRODUCER GAS

TAKES GAS GASOLINE FROM

DOES NOT INCREASE INSURANCE. SAFE. RELIABLE. ECONOMICAL. SIMPLE. NO DELICATE PARTS.

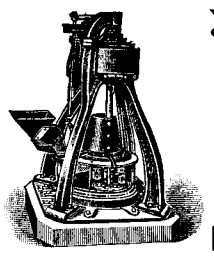
TANK LOWER THAN ENGINE AND OUTSIDE OF BUILDING IF DESIRED.

H.W. CALDWELL & SON. SOLE MF'RS

WASHINGTON & UNION STS. CHICAGO, ILLS.

ALUMINUM: ITS USES AND APplications. A valuable and interesting article by G. L. Addenbrooke. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 859. Price 10 cents. To be had at this office and from all newsdealers.

BEATTY Organs, 27 stops $22. Pianos, $150 Catal. free. Dan'l F. Beatty, Wash'ton, N.J



THE GRIFFIN MILL

A perfect pulverizer of all refractory substances by either the wet or dry process. It works better and at less expense than any other Mill, and is conceded to be the only perfect pulverizing Mill manufactured.

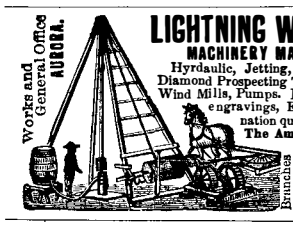
For FREE Illustrated Pamphlet address

BRADLEY FERTILIZER CO., 92 STATE ST, BOSTON.

SPECIAL NOTICE!

Two handsome photo-engraved display sheets entitled, "Recent Improvements in Air Compressors," "Recent Improvements in Rock Drills," mailed free to any one who will cut out this advertisement and mail it to us with his name and address.

INGERSOLL-SERGEANT DRILL CO. Havemeyer Bldg., Cortlandt St., New York, U.S.A.



LIGHTNING WELL-SINKING MACHINERY MANUFACTURERS.

Hydraulic, Jetting, Revolving, Artesian, Diamond Prospecting Tools, Engines, Boilers, Wind Mills, Pumps. Encyclopedia, 1,000 engravings, Earth's Strata, Determination quality water; mailed, 25c.

The American Well Works, Aurora, Ill.

Branches { 11 & 13 S. Canal St., Chicago, Ill. Dallas, Texas.

Rubber Rolls and Wheels.

Power Wringing Machines, Drying and Ventilating Fans. All styles of Trucks made to order. Catalogues free. GEORGE P. CLARK, Box L, Windsor Locks, Conn.

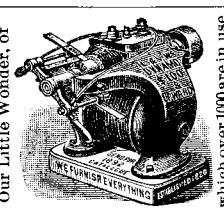
OIL WELL SUPPLY CO.

91 & 92 WATER STREET, PITTSBURG, PA.

Manufacturers of everything needed for

ARTESIAN WELLS

for either Gas, Oil, Water, or Mineral Tests. Boilers, Engines, Pipe, Cordage, Drilling Tools, etc. *Illustrated catalogue, price lists, and discount sheets on request.*



NICKEL AND ELECTRO-PLATING

Apparatus and Material.

THE Hanson & Van Winkle Co. Newark, N. J. 81 LIBERTY ST., N. Y. 23 S. CANAL STREET, CHICAGO.

Columbian Exposition Electrical Bldg., Section L, Col. 4

THE COPYING PAD.—HOW TO MAKE and how to use; with an engraving. Practical directions how to prepare the gelatine pad, and also the aniline ink by which the copies are made, how to apply the written letter to the pad, how to take off copies of the letter. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 438. Price 10 cents. For sale at this office and by all newsdealers in all parts of the country.

Steel Type for Writing Machines, J. D. MALLONEE, M'f'r, STOCKTON, N. Y.

FOOT POWER LATHES

For Electrical and Experimental Work. For Gunsmiths & Tool Makers. For General Machine Shop Work.

High Grade Tools; elegant in design, superior in construction. The best foot power lathes made, and quality considered, the cheapest. *Send for catalogue and prices.*

W. F. & JOHN BARNES CO., 1999 Ruby St., Rockford, Ill.

GASOLINE ENGINES.

Stationary & Portable

ALL SIZES.

Dwarfs in size and Giants in Strength.

Costs only 10 cents a Day per H. P. to run them, & scarcely any attention.

EVERY ENGINE GUARANTEED

Write for particulars and testimonials.

THE VANDUZEN GAS & GASOLINE ENGINE CO. CINCINNATI, O.

Mention this paper when you write.

CHAPMAN VALVE MANUFACTURING COMPANY,

MANUFACTURERS OF

Valves and Gates

For STEAM, WATER, GAS, AMMONIA, OIL, ACID, Etc.; also GATE FIRE HYDRANTS.

We make a Specialty of Valves for Superheated and High Pressure Steam, 100 Pounds Pressure and Upwards.

General Office and Works, INDIAN ORCHARD, MASS.

Treasurer's Office, 72 KILBY STREET, BOSTON. Chicago Office, 24 WEST LAKE STREET.

☞ *All work Guaranteed.* *Send for Circulars and Prices.*

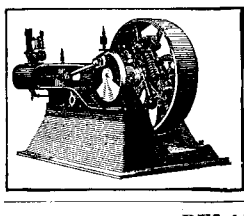
MANUFACTURERS and INVENTORS ATTENTION!

We are prepared to design, give estimates on, and manufacture Light Machinery, Electrical Appliances, and Metal Specialties of every description. Also Models, Dies, Special Tools and Patterns.

WE ALSO MAKE GEAR CUTTING A SPECIALTY.

GARDNER SEWING MACHINE CO.

Factory and Main Office, cor. State & Claim Sts., Aurora, Ill. Chicago Office, 247 Monroe Street, Chicago, Ill. Direct all correspondence to Main Office, Aurora, Ill.



THE STURTEVANT AUTOMATIC STEAM ENGINES HORIZONTAL & UPRIGHT.

SEND FOR CATALOGUES TO B. F. STURTEVANT CO. BOSTON, MASS. NEW YORK. PHILA. CHICAGO. LONDON.

THE CHASE WOOD RIM PULLEY

ALL IRON EXCEPT THE RIM

BORED TO SHAFT SIZE. KEYSEATS AND SET SCREWS SAME AS AN ALL IRON PULLEY. LARGE PULLEYS FOR ANY AMOUNT OF HORSE POWER

A SPECIALTY. SEND FOR DESCRIPTIVE CIRCULAR TO F. A. CHASE & CO. MFRS. 7 EDDY St. PROVIDENCE R.I.

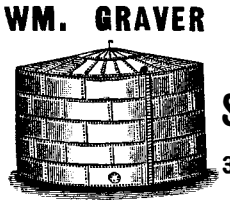
DELANEY'S Expansion Packings for Steam, Water & Ammonia are best and cheapest.

DELANEY'S Metallic Gaskets and Flanges make everlasting joints.

H. J. Delaney & Co. Mfrs. Third & Fowler Sts., Milwaukee, Wis.

The Orcutt Comp'y Leading Lithographers Chicago. CORRESPONDENCE SOLICITED.

WM. GRAVER TANK WORKS, (INCORPORATED.)



Manufacturers of Iron and Steel

STORAGE TANKS.

OFFICE, 3d Floor, Rookery Bldg. CHICAGO, ILL.

A MODERN BATH . . . The Latest and Best.

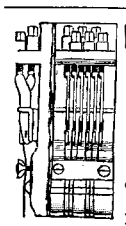
Quick Self-Heating; or Toilet Cabinet in place of Heater. No bath room required. Ornamental, inexpensive, complete, practical. Desirable for either city or town. Send 2c. for catalogue illustrating 18 styles

Moseley Folding Bath Tub Co 181 M. So. Canal St., Chicago, Ill

MODEL WORK.

Estimates given for the manufacture, in quantities, of any article in metal or wood. Coin operated slot machines a specialty. Send stamp for catalogue. Amer. Vending Mach. Co., 29 Murray Street, New York.

PATTERN MAKER, H. VAN SANDS, 144 Centre St., N. Y.



MASON & HAMLIN SCREW STRINGER

One of the greatest improvements in the history of the Piano Forte.

Keeps the Piano in Tune. Much More Durable, Quality of Tone Purer.

☞ *Fully Illustrated Catalogue sent on application.*

Mason & Hamlin Organ & Piano Co. 152 TREMONT ST., BOSTON, MASS.

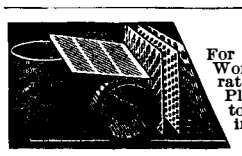
STOW FLEXIBLE SHAFT.

INVENTED AND MANUFACTURED BY THE STOW MFG. CO. 440 STATE ST

PORTABLE DRILLS. CENTRE GRINDERS. TAPPING & REAMING MACHINES FOR BOILER AND BRIDGE MAKERS USE. FLEXIBLE BORING MACHINES FOR CARRIAGE MAKERS AND BLACKSMITHS USE. AND ALL KINDS OF TOOLS OPERATED WITH THE FLEXIBLE SHAFT

BINGHAMTON, N.Y.

AN IDEAL STUB PEN—Esterbrook's Jackson Stub, No. 442 A specially EASY WRITER, a GOOD INK HOLDER and a DELIGHT to those who use a STUB PEN. ASK YOUR STATIONER FOR THEM. Price, $1.00 per gross. THE ESTERBROOK STEEL PEN CO., 26 John St., New York.



PERFORATORS OF ALL METALS

For Cotton, Oil and Rice Mills, Sugar Houses, Distilleries, Phosphate and Fertilizer Works, Mining and Concentrating, Gas and Water Works, Elevators, Threshers, Separators, Corn Shellers, and all kinds of Grain Cleaning Machinery. Heavy Steel and Iron Plates and Cylinders for Screening Ore, Coal, Stone. For Filters, Strainers, Ventilators, Oil, Gas and Vapor Stoves and all special purposes. Special sizes for Coffee Cleaning and Roasting Machinery. Perforated Tin and Brass.

The Harrington & King Perforating Co., Chicago, and 234 Pearl St., N.Y

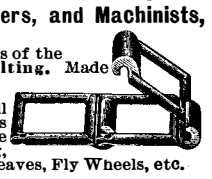
LINK-BELT MACHINERY CO.

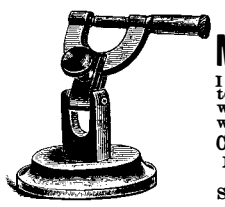
Engineers, Founders, and Machinists, CHICAGO.

Exclusive manufacturers of the Original Ewart Link Belting. Made in 51 regular sizes.

Sprocket Wheels.

Machinery for handling all kinds of Freight, Cereals, Ores Refuse, etc. Manila Rope Power Transmissions, Shafting, Pulleys, Hangers, Gearing, Sheaves, Fly Wheels, etc.





CHANDLER'S Micrometer Holder

It allows the hand to be free to use the adjusting screw while the other holds the work. Price 50 cents.

CHANDLER & FARQUHAR No. 179 Washington Street, BOSTON, MASS. Send for Catalogue of Tools

ELECTRO MOTOR, SIMPLE, HOW TO make. By G. M. Hopkins.—Description of a small electric motor devised and constructed with a view to assisting amateurs to make a motor which might be driven with advantage by a current derived from a battery, and which would have sufficient power to operate a foot lathe or any machine requiring not over one man power. With 11 figures. Contained in SCIENTIFIC AMERICAN SUPPLEMENT, No. 641. Price 10 cents. To be had at this office and from all newsdealers.

MILLER & VAN WINKLE STEEL WIRE AND STEEL SPRINGS

TEMPERED STEEL WIRE

TEMPERED COMPRESSION & EXTENSION SPRINGS A SPECIALTY.

MACHINERY SPRINGS.

OFFICE & WORKS 18 TO 24 BRIDGE ST. BROOKLYN, N.Y.

KEMP'S MANURE SPREADER

Spreads any and all kinds of yard and stable manure. Its chief merit is in the thorough pulverizing and even distribution, though it will discharge its load in one-tenth the time required by hand.

KEMP & BURPEE MFG. CO. Box 66. SYRACUSE, N. Y., U. S. A.

THE

SCIENTIFIC AMERICAN

☞ ESTABLISHED 1845.

The Most Popular Scientific Paper in the World

Only $3.00 a Year, Including Postage.

Weekly—52 Numbers a Year.

This widely circulated and splendidly illustrated paper is published weekly. Every number contains sixteen pages of useful information and a large number of original engravings of new inventions and discoveries, representing Engineering Works, Steam Machinery, New Inventions, Novelties in Mechanics, Manufactures, Chemistry, Electricity Telegraphy, Photography, Architecture, Agriculture, Horticulture, Natural History, etc. Complete list of patents each week.

Terms of Subscription.—One copy of the SCIENTIFIC AMERICAN will be sent for *one year*—52 numbers—postage prepaid, to any subscriber in the United States, Canada, or Mexico, on receipt of **three dollars** by the publishers; six months, $1.50; three months, $1.00.

Clubs.—Special rates for several names, and to Post Masters. Write for particulars.

The safest way to remit is by Postal Order, Draft, or Express Money Order. Money carefully placed inside of envelopes, securely sealed, and correctly addressed, seldom goes astray, but is at the sender's risk. Address all letters and make all orders, drafts, etc., payable to

MUNN & CO., 361 Broadway, New York.

THE

Scientific American Supplement

This is a separate and distinct publication from THE SCIENTIFIC AMERICAN, but is uniform therewith in size, every number containing sixteen large pages full of engravings, many of which are taken from foreign papers and accompanied with translated descriptions. THE SCIENTIFIC AMERICAN SUPPLEMENT is published weekly, and includes a very wide range of contents. It presents the most recent papers by eminent writers in all the principal departments of Science and the Useful Arts, embracing Biology, Geology, Mineralogy, Natural History, Geography, Archæology, Astronomy Chemistry, Electricity, Light, Heat, Mechanical Engineering, Steam and Railway Engineering, Mining, Ship Building, Marine Engineering, Photography, Technology, Manufacturing Industries, Sanitary Engineering, Agriculture, Horticulture, Domestic Economy, Biography, Medicine, etc. A vast amount of fresh and valuable information obtainable in no other publication.

The most important Engineering Works, Mechanisms, and Manufactures at home and abroad are illustrated and described in the SUPPLEMENT.

Price for the SUPPLEMENT for the United States, Canada, and Mexico, $5.00 a year; or one copy of the SCIENTIFIC AMERICAN and one copy of the SUPPLEMENT, both mailed for one year to one address for $7.00. Single copies, 10 cents. Address and remit by postal order, express money order, or check,

MUNN & CO., 361 Broadway, New York,

Building Edition.

THE SCIENTIFIC AMERICAN ARCHITECTS' AND BUILDERS' EDITION is issued monthly. $2.50 a year. Single copies, 25 cents. Thirty-two large quarto pages, forming a large and splendid Magazine of Architecture, richly adorned with *elegant plates in colors*, and with other fine engravings; illustrating the most interesting examples of modern architectural construction and allied subjects.

A special feature is the presentation in each number of a variety of the latest and best plans for private residences, city and country, including those of very moderate cost as well as the more expensive. Drawings in perspective and in color are given, together with Plans, Descriptions, Locations, Estimated Cost, etc.

The elegance and cheapness of this magnificent work have won for it the **Largest Circulation** of any Architectural publication in the world. Sold by all newsdealers. $2.50 a year. Remit to

MUNN & CO., Publishers, 361 Broadway, New York.

© 1893 SCIENTIFIC AMERICAN, INC.

Founded by Mathew Carey, 1785.

HENRY CAREY BAIRD & CO.
Industrial Publishers, Booksellers, and Importers,
810 Walnut St., Philadelphia, Pa., U. S. A.

☞ Our new and Revised Catalogue of Practical and Scientific Books, 88 pages, 8vo, and our other Catalogues and Circulars, the whole covering every branch of Science applied to the Arts, sent free and free of postage to any one in any part of the world who will furnish his address.

Dixon's Silica Graphite Paint

Is unaffected by heat, cold, dampness, rusts or acid vapors. Economical and healthful. Beautiful as well as durable.

For tin, iron or shingle roofs, iron and wooden structures of all kinds, and wherever a dark-colored paint can be used, Dixon's Graphite Paint is unequaled.

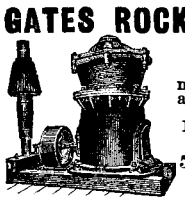
Send for circulars and testimonials.

JOS. DIXON CRUCIBLE CO.
Jersey City, N. J.

THE ARMSTRONG MACHINES,
For Cutting Off and Threading Pipe.

For Hand or Power.
No. 1 cuts off and threads 1 to 3 inch.
No. 2 cuts off and threads 1 to 4 inch.
No. 3 cuts off and threads 1 to 6 inch.
Our aim is to make these machines as good as our Stocks and Dies, which are universally acknowledged to be THE BEST. ☞ Send for catalogue.
THE ARMSTRONG MFG. CO., Bridgeport, Ct.

GATES ROCK & ORE BREAKER



Capacity up to 200 tons per hour.
Has produced more ballast, road metal, and broken more ore than all other Breaks combined.
Builders of High Grade Mining Machinery. Send for Catalogues.
GATES IRON WORKS,
50 C So. Clinton St., Chicago
136 C, Liberty Street, New York,
237 C, Franklin St., Boston, Mass

HOW TO KNOW THE WILD FLOWERS

A Guide to the names, haunts, and habits of our common Wild Flowers. By Mrs. Wm. Starr Dana. Illustrated by Marion Satterlee. Containing descriptions of more than 400 flowers, with 100 illustrations, 298 pages, square 12mo, cloth. $1.50, by mail, postpaid.
For sale by MUNN & CO.,
Publishers of SCIENTIFIC AMERICAN,
361 Broadway, New York.

ABOUT MAGIC LANTERNS
ASK US
WE MAKE THEM.
J. B. COLT & CO.
16 BEEKMAN ST. NEW YORK — 189 LA SALLE ST CHICAGO, Ill.

NEW DEPARTURE IN LANTERN PROjection, by means of the
Incandescent Electric Current,
both alternating and direct, with the
PARAGON ARC LIGHT PROJECTOR.
Send for Catalogue to QUEEN & CO., Phila.

FREE A fine 14k gold plated watch to every reader of this paper. Cut this out and send it to us with your full name and address, and we will send you one of these elegant, richly jeweled, gold finished watches by express for examination, and if you think it is equal in appearance to any $25.00 gold watch, pay our sample price, $3.50, and it is yours. We send with the watch our guarantee that you can return it at anytime within one year if not satisfactory, and if you sell or cause the sale of six we will give you ONE FREE. Write at once, as we shall send out samples for 60 days only.
THE NATIONAL M'F'G & IMPORTING CO.,
334 Dearborn St., Chicago, Illinois.

JUST PUBLISHED.

Star ★ Maps

By Richard A. Proctor, F.R.A.S.

* * *

A series of twelve elegantly printed Maps of the Heavens, one for every month in the year. Specially prepared for use in North America. With descriptions accompanying each map, giving the names of the principal stars and constellations, showing their relative positions at given hours and days of the month.

A most beautiful and convenient work, specially adapted for the use of those who desire to acquire a general knowledge of the starry realms.

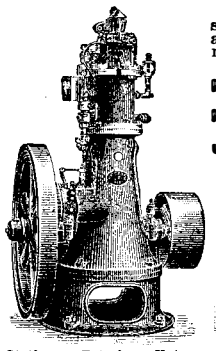
To which is added a description of the method of preparing and using artificial luminous stars as an aid in fixing in the mind the names and places of the various stars and constellations, by Alfred E. Beach.

Altogether this is one of the most popular, useful, and valuable works of the kind ever published.

One quarto volume, elegantly bound in cloth. Price $2.50, postpaid.

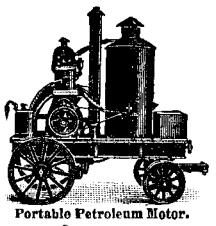
MUNN & CO., Publishers,
361 Broadway, New York.

PATENT PETROLEUM MOTORS. NO BENZINE

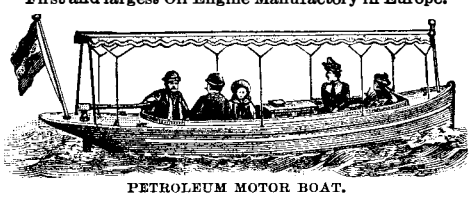


Stationary Petroleum Motor.

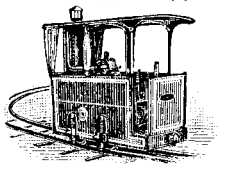
Specially adapted to run all kinds of machinery used in small industries, mills, small electric light plants, pumps, all kinds of vehicles, etc., etc. No Racer. Over 1500 motors already in use. Received awards at all Expositions. Motors of from ⅛ to 30 h. p. ready for delivery.
☞ Our Motors are exhibited at Columbian Exposition, Chicago, Section F, No. 1526.
☞ *Send for Illustrated Catalogue and Price List, Free.*
J. M. GROB & CO., Mfrs. Leipzig-Eutritzsch, GERMANY.
First and largest Oil Engine Manufactory in Europe.



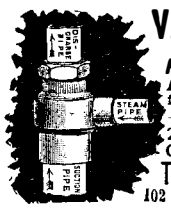
Portable Petroleum Motor.



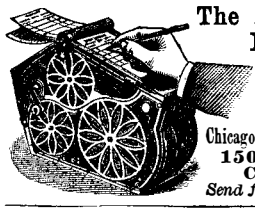
PETROLEUM MOTOR BOAT.



Petroleum Locomotive.



VANDUZEN STEAM JET PUMP
THE BEST IN THE WORLD.
Pumps Any Kind of Liquid.
Always in Order, never Clogs nor freezes. Every Pump Guaranteed.
—10 SIZES.—
200 to 12000 Gallons per Hour.
Cost $7 to $75 each. Address
THE VANDUZEN & TIFT CO.,
102 to 108 E. Second St., Cincinnati, O.



The AUTOGRAPHIC REGISTER.
A Labor-Saving Business System.
Enforcing Honesty and Accuracy.
Chicago Autographic Register Co.
150 E. Monroe Street,
CHICAGO, ILL.
Send for catalogue & price list.

Visitors to the WORLD'S FAIR

should inspect the handsome Registers, Sunshine Recorders, Anemometers, and other Meteorological apparatus on exhibit in Weather Bureau Building, from Julien P. Friez, 107 E. Ger. St., Baltimore, Md., U. S. A., who also manufactures Heliographs for U. S. Army and State Militias.
Write for Catalogue.

ALANSON CARY
MANUFACTURER OF
STEEL SPRINGS
OF EVERY DESCRIPTION
240 & 242 W 29TH ST. NEW-YORK

WEBER GAS AND GASOLINE ENGINE

Simplest and most economical engines on earth.
Fully Guaranteed.
A boy starts it, requires only a few minutes' attention a day. Guaranteed cost of running 1 ct per hour per H. P. Write for catalogue. Address Drawer 200,
Weber Gas & Gasoline Engine Co.
KANSAS CITY, MO.

C. HOCHSTRASSEL.
All kinds metal patterns and experimental work a specialty. No. 84 E. South Market St., Chicago Ill.

AIR COMPRESSOR FOR SALE.
A duplex steam-driven Knowles Air Compressor. Air cylinders 10" x 12", steam 8" x 12". Absolutely as good as new in every particular. Been used very little. Change of oil fuel system reason for selling. Address
AMERICAN PROJECTILE CO., LYNN, MASS.

WIZARDS MAGIC PURSE

The most bewildering illusion discovered in this century. A very strong purse of the finest dressed kid strongly sewed and beautifully embroidered. (Regular goods of equal quality sell for 50c. to 75c.) Comprises 3 pockets, which we GUARANTEE no one can open in 3 hours without knowing the secret. It has baffled all experts in puzzledom. A great novelty, a wonderful mystery, and a useful article, all in one. Your money and secrets are safe inside this purse. Satisfaction guaranteed. Sample with secret in sealed envelope, postpaid, with catalogue of 1,000 useful articles, 25c., 3 for 60c., 6 for $1.00, $1.80 a dozen.
R. H. Ingersoll & Bro., 65 Cortlandt St., N. Y.

MALLEABLE AND PIG IRON ALSO STEEL CASTINGS FROM SPECIAL PATTERNS FOR ENGINE JAPANNING AND FINISHING
THOMAS DEVLIN & CO. LEHIGH AVE. & AMERICAN ST. PHILA

SYLPH CYCLES RUN EASY
Agents Wanted
Pneumatics not enough; springs necessary for comfort & safety. Sylph spring frame saves muscle & nerves & is perfection. All users delighted. Investigate. We also make a 30 lb. rigid Sylph. Cata. free.
Rouse-Duryea Cycle Co. *Mfrs.* 16 G st., Peoria, Ill.

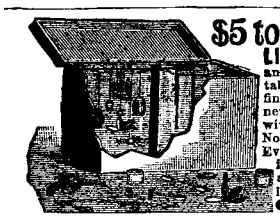
MINING AND PROSPECTING TAUGHT BY MAIL
ALSO, MECHANICAL DRAWING, *Mechanics, Arithmetic, etc.* To begin, students only need know how to read and write. DIPLOMAS Awarded. Low Prices. Send for FREE Circular to The Correspondence School of Mines, Scranton, Pa.

$20 Buy Direct and Save 50 Per Cent.

All riders say they cannot see how we can do it for the money: $20 buys an elegant Oxford finely finished and nickel plated Bicycle, warranted to be first class, simple in construction, strong, durable and accurately fitted, which makes riding on our Wheel a pleasure instead of hard work; material we use is of the highest grade, each wheel guaranteed. Write to-day for our illustrated FREE catalogue.
DEPT. B—OXFORD MFG. CO. 338 WABASH AVE. CHICAGO.

MAJOR'S CEMENT MENDS EVERYTHING
15 and 25 cents. At all Druggists or by Mail. Major's Leather Cement mends everything in leather. 10, 15 and 20c. Major's Rubber Cement repairs everything in rubber, 15c. A. MAJOR'S CEMENT CO., 232 William St., N. Y.

JAPANNING, ENAMELING & DECORATING WRITE FOR PRICES.
ON WOOD OR METAL.
LARGEST AND MOST COMPLETE PLANT IN THE COUNTRY FOR THIS CLASS OF WORK. BICYCLE ENAMELING A SPECIALTY
AUTOMATIC M'F'G CO., COR. 37 ST. & 1 AVE. NEW YORK.



$5 to $15 per day, at home, selling **LIGHTNING PLATER** and plating jewelry, watches tableware, &c. Plates the finest of jewelry good as new, on all kinds of metal with gold, silver or nickel. No experience. No capital. Every house has goods needing plating. Wholesale to agents $5. Write for circulars. H. E. DELNO & Co., Columbus, O.

EXPERT MODEL MAKING. Established 1867.
J. C. SEYL, Prop. Chicago Model Works, Chicago, Ill., 179 E. Madison St. Write for Catalogue of Model Supplies.

STORAGE BATTERIES. WRITE FOR PARTICULARS.
STORAGE BATTERY SUPPLY CO 23d ST. & 1st AVE. NEW YORK

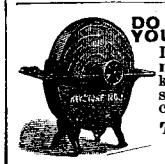
FRUIT EVAPORATOR
"The Granger." For family use. *Cheapest in the market.* $3.50, $6 & $10. Circular
Eastern Mfg. Co., 259 South 5th St., Phila., Pa.

"ECONOMY IS WEALTH."
Canvassers wanted to sell the New Model Hall Typewriter. Why will people buy a $100 machine when $30 will purchase a better one? Send for illustrated catalogue and terms to County Agents.
Address N. TYPEWRITER CO.
611 Washington Street, Boston, Mass.
Mention Scientific American.

MY WIFE SAYS SHE CANNOT SEE HOW YOU DO IT FOR THE MONEY. $12 Buys a $65.00 Improved Oxford Singer Sewing Machine; perfect working, reliable, finely finished, adapted to light and heavy work, with a complete set of the latest improved attachments free. Each machine guaranteed for 5 years. Buy direct from our factory, and save dealers and agents profit. Send for FREE CATALOGUE.
OXFORD MFG. COMPANY, DEPT D, 18 CHICAGO, ILL.

WANTED—Foreman. Duties, to design and oversee making of tools for presses, screw and milling machines, etc., and superintend manufacture of large quantities of small, fine brass goods. A man thoroughly practical and successful in designing tools and in details of manufacture can find an excellent position. Address, giving age, experience, etc., G. H., care Sci. Am

DO YOU USE GRINDSTONES?



If so, we can supply you. All sizes mounted and unmounted, always kept in stock. Remember, we make a specialty of selecting stones for all special purposes. ☞ *Ask for catalogue.*
The CLEVELAND STONE CO.
2d Floor, Wilshire, Cleveland, O.

If you want the best Lathe and Drill
CHUCKS,

BUY WESTCOTT'S. *Strongest Grip, Greatest Capacity and Durability, Cheap and Accurate.*
Westcott Chuck Co., Oneida, N. Y., U. S. A.
Ask for catalogue in English, French, Spanish or German.

WOODEN TANKS FOR RAILROADS
LARGE WATER TANKS
PLANS & A SPECIALTY.
SPECIFICATIONS FURNISHED FOR FOUNDATIONS & TOWERS.
WATER WORKS, MILLS, FARMS &c.
COMPLETE STOCK OF CYPRESS LUMBER.
W. E. CALDWELL CO
No. 217 E. MAIN ST. LOUISVILLE KY.

MECHANICS' TOOLS.
If you are interested in Tools as a manufacturer or amateur, you should have a copy of our new catalogue. Our 1892 edition is a very elaborate and complete book of 704 pages, handsomely bound in cloth. The book will be sent to any part of the world, prepaid, on receipt of $1.00, and the money thus paid will be refunded with the first purchase amounting to $10.00 or over. Every manufacturer and amateur should have this catalogue, even if they do not intend buying their Tools and Supplies of us.
MONTGOMERY & CO., Fine Tools,
105 Fulton Street, New York City, N. Y.

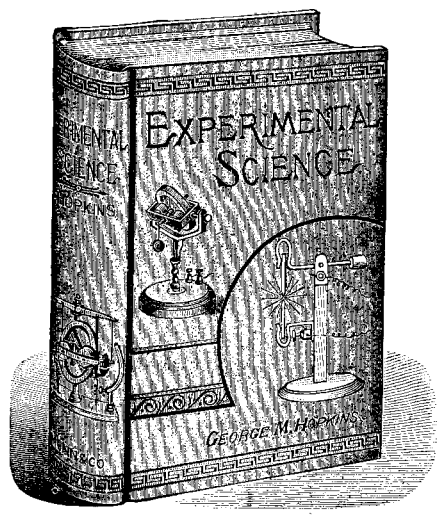
STEEL TYPE FOR TYPEWRITERS

Stencils, Steel Stamps, Rubber and Metal Type Wheels, Dies, etc.
Model and Experimental Work. Small Machinery, Novelties, etc., manufactured by special contract.
New York Stencil Wks. 100 Nassau St., N. Y

SELTZATEURS for home-made Soda Water, etc., $4.50 and up. Family Ice Machine $10 and up. Filters, $1.25 and up. Cookers, $1. L. DERMIGNY, 126 West 25th St., New York.

THE "COLUMBIA"
CRUDE OIL BURNER and AIR INJECTOR
MANUFACTURED BY
SHIPMAN ENGINE MANUF'G CO., Rochester, N. Y.

NOW READY!
Fourteenth Edition of
Experimental Science



REVISED AND ENLARGED.
120 Pages and 110 Superb Cuts added.

The unprecedented sale of this work shows conclusively that it is the book of the age for teachers, students, experimenters, and all others who desire a general knowledge of Physics or Natural Philosophy.

In the new matter contained in the last edition will be found the Scientific Use of the Phonograph, the curious optical illusion known as the Anorthoscope, together with other new and interesting Optical Illusions, the Optical Projection of Opaque Objects, new experiments in Projection, Iridescent Glass, some points in Photography, including Hand Cameras, Cane Cameras, etc.; Systems of Electrical Distribution, Electrical Ore Finder, Electrical Rocker, Electric Chimes, How to Color Lantern Slides, Study of the Stars, and a great deal of other new matter which will prove of interest to scientific readers.

840 pages, 782 fine cuts, substantially and beautifully bound. Price in cloth, by mail, $4. Half morocco, $5.
☞ *Send for illustrated circular.*
MUNN & CO., Publishers,
Office of the SCIENTIFIC AMERICAN,
361 BROADWAY, NEW YORK.

PROPOSALS.

SEALED TENDERS WILL BE RECEIVED BY the Government of Newfoundland, addressed to the Colonial Secretary, on or before the 15th day of August next, for a lease of the St. John's First Class Simpson's Improved Dry Dock, and of the harbor works in connection therewith, for a term of ten, fifteen or twenty years. The Dry Dock is 620 feet in extreme length, with a draft of 25 feet of water on the sill at high tide. It is built of concrete, pitch pine and oak, and is in good condition. The property is equipped on one side of the dock with all necessary repair, shop and office accommodation, in a brick building 400 feet long, 30 feet wide and 16 feet height of wall. The shop is provided with 1 vertical drill, 1 punch and shears, 1 set plate rolls, electric light plant, and engine and boiler, with necessary shafting. In separate brick building, on the same side of the dock, is the pumping installation, consisting of two W. H. Allan's 30-inch centrifugal pumps (direct acting horizontal engines) and one 10-inch centrifugal (engine, compound, double, vertical), all supplied by a pair of marine boilers. The gate is a floating iron caisson, provided with steam warping capstan and steam ballast pump. Tenders must state term of years proposed, rent and securities for performance of contract. Further particulars may be had on application to me.
R. BOND. Colonial Secretary, St. John's, Newfoundland.

STEREOPTICONS. MAGIC LANTERNS AND ACCESSORIES, SEND FOR CATALOGUE TO CHAS BESELER MAKER 218 CENTRE ST. NEW YORK;

WATER WHEELS JAMES LEFFEL & CO., SPRINGFIELD, OHIO, U.S.A.
Send for our fine large PAMPHLET.

CHEAPER THAN WINDMILLS
ALWAYS READY, NO BOILER, NO FIRE, NO ENGINEER, NO LICENSE, NO DANGER. STATIONARY, MARINE AND PORTABLE ENGINES FOR BOATS, PUMPS, FACTORIES ETC.
SMALL SIZES A SPECIALTY.
SAFETY VAPOR ENGINE Co.
SEND FOR CATALOGUE
16 MURRAY ST. NEW YORK.

The Shimer Cutter Heads
45,000 SOLD.
To work Car Siding, Flooring Ceiling and Ship Lap; to Mould Doors, Sash and Blinds. Cope Heads to match.
Sam'l J. Shimer & Sons, Centre St., Milton, Pa.

18K GOLD PLATED $3.37

HILL HE PAYS THE EXPRESS
ONE FREE if you order Five. Cut this ad. out and send to us and we will send you this beautiful 18k Gold plated watch by express, subject to full examination, and if you do not find it equal to any watch retailed at 4 times the price we ask, you need not pay one cent. Otherwise pay the express agent $3.37 and the watch is yours. The movement is a jeweled quick train, with oil-tempered pinion and hair Spring. It is a durable and accurate Timekeeper. The case is made of Coin Nickel hand engraved (cut shows back of case) over which is placed 2 plates 18k Gold. Fully warranted. In carrying this watch you have the credit of owning a SOLID GOLD WATCH.
W. HILL & CO.
Wholesale Jewelers,
207 State St. Chicago Ills

WORKING MODELS & LIGHT MACHINERY. INVENTIONS DEVELOPED. Send for Model Circular. Jones Bros. E Co., Cin'ti. O.

© 1893 SCIENTIFIC AMERICAN, INC.

Advertisements.

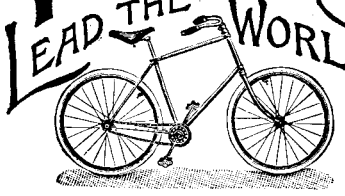
ORDINARY RATES.

Inside Page, each insertion, - 75 cents a line
Back Page, each insertion, - - $1.00 a line

☞ *For some classes of Advertisements, Special and Higher rates are required.*

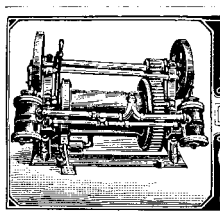
The above are charges per agate line—about eight words per line. This notice shows the width of the line, and is set in agate type. Engravings may head advertisements at the same rate per agate line, by measurement, as the letter press. Advertisements must be received at Publication Office as early as Thursday morning to appear in the following week's issue.

Victors Lead the World



OVERMAN WHEEL CO.
BOSTON. WASHINGTON. DENVER. SAN FRANCISCO.

A. G. SPALDING & BROS., Special Agents,
CHICAGO. NEW YORK. PHILADELPHIA.



HOISTING ENGINES
FOR EVERY DUTY AND OF ANY SIZE.
SEND FOR CATALOGUE AND PRICES.
COPELAND & BACON
85 LIBERTY ST. NEW YORK.

COLD FORGED PRODUCT.

Fluted Tire Bolt

Patented Nov. 11, 1890; Oct. 20, 1891.

Is stiffer and stronger than a common bolt. The fluted shank prevents the bolt from turning in the rim and tire.

COLD FORGED { MACHINE SCREWS, STOVE BOLTS, LOCK CAP SCREWS, SIDE KNOB SCREWS, THREADED WIRES

AMERICAN SCREW COMPANY,
PROVIDENCE, R. I.

SAWS Wanted 50,000 Sawyers and Lumbermen to send us their full address for a copy of Emerson's Book of SAWS, new 1892 edition. We are first to introduce NATURAL GAS for heating and tempering Saws with wonderful effect upon improving their quality and toughness, enabling us to reduce prices. Address EMERSON, SMITH & CO. (Limited), Beaver Falls, Pa. **SAWS**

RIEDLER PUMPING ENGINES AND AIR COMPRESSORS ARE POSITIVELY BETTER THAN ANY OTHERS UPON THE MARKET.
FOR EVIDENCE OF THIS FACT WRITE FOR PARTICULARS TO
FRASER & CHALMERS
133 FULTON ST. W. CHICAGO, ILL.

"Wise men
change their minds sometimes."

They accept new light; they realize that there is an improved, perfected, **quick-winding** Waterbury watch; in coin-silver and gold, filled, cases. An entirely different affair from the one laughed at of old; winding in five seconds; surpassing in style and quality anything deemed possible at the price; elegant enough for any lady to carry, and satisfying the accurate business man. Far superior to any cheap Swiss watch; with closer and more uniform adjustment.

Your jeweler keeps this watch in many different styles, a boy's watch included; all stem-winders. $4 to $15.

PATENTS!

MESSRS. MUNN & CO., in connection with the publication of the SCIENTIFIC AMERICAN, continue to examine improvements, and to act as Solicitors of Patents for Inventors.

In this line of business they have had *forty-five years' experience*, and now have *unequaled facilities* for the preparation of Patent Drawings, Specifications, and the prosecution of Applications for Patents in the United States, Canada, and Foreign Countries. Messrs. Munn & Co. also attend to the preparation of Caveats, Copyrights for Books, Labels, Reissues, Assignments, and Reports on Infringements of Patents. All business intrusted to them is done with special care and promptness, on very reasonable terms.

A pamphlet sent free of charge, on application, containing full information about Patents and how to procure them; directions concerning Labels, Copyrights, Designs, Patents, Appeals, Reissues, Infringements, Assignments, Rejected Cases. Hints on the sale of Patents, etc.

We also send, *free of charge*, a Synopsis of Foreign Patent Laws, showing the cost and method of securing Patents in all the principal countries of the world.

MUNN & CO., Solicitors of Patents,
361 Broadway, New York.

BRANCH OFFICES.—Nos. 622 and 624 F Street, Pacific Building, near 7th Street, Washington, D. C.

SEND FOR OUR CIRCULAR.

IN ONE MINUTE

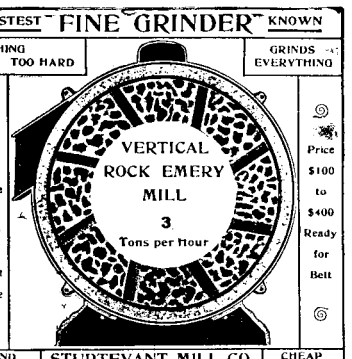
IT WILL CONVINCE YOU OF OUR ABILITY TO SUPPLY TOILET PAPER FOR LESS MONEY THAN IT CAN BE OBTAINED ELSEWHERE. **A.P.W. PAPER CO.** ALBANY, N.Y.

SCIENTIFIC AMERICAN SUPPLEMENT. Any desired back number of the SCIENTIFIC AMERICAN SUPPLEMENT can be had at this office for 10 cents. Also to be had of newsdealers in all parts of the country.

FASTEST FINE GRINDER KNOWN

NOTHING TOO HARD — GRINDS EVERYTHING

Emery Stones will replace Burrs in any Mill without change



Price $100 to $400 Ready for Belt

SEND FOR CIRCULAR — STURTEVANT MILL CO. Boston, Mass. — CHEAP HARD DURABLE

KODAKS.

Take one with You
to the World's Fair.

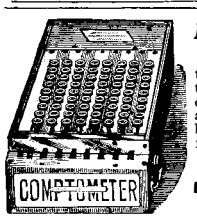
They're the only practical camera for the purpose. No bulky glass plates—no troublesome holders—no need of hunting up a dark room. With our special Columbian spools of film, containing 200 exposures you can have your Kodak loaded before leaving home and can then "*press the button*" as often as you like, while at the Fair, without the necessity of reloading.

Eastman Kodak Co.,
{Send for Catalogue.} Rochester, N. Y.

They Buy Columbia Bicycles.

Men who **know** bicycles always buy Columbias. Why? You know why! Columbias stand by themselves — above all bicycles.

Columbia Catalogue. 45 comprehensive engravings. The most exhaustive cycling catalogue published. Free at Columbia agencies. By mail for two two-cent stamps. Pope Mfg. Co., Boston, New York, Chicago, Hartford.

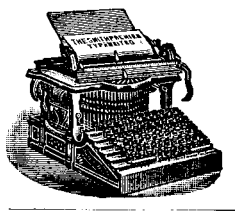


MR. BOOKKEEPER,

do you know what the Comptometer is? It costs you nothing to find out. It will help you out on that trial balance. It insures accuracy, is twice as rapid as the best accountant and relieves all nervous and mental strain.

Write for Pamphlet.

FELT & TARRANT MFG CO.
52-56 ILLINOIS ST., CHICAGO.



"IMPROVEMENT THE ORDER OF THE AGE."

The Smith Premier Typewriter

Embodies the most Progressive Mechanical Principles.
All the Essential Features Greatly Perfected.
Perfect and Permanent Alignment.
Easiest Running, and Nearly Silent.
All type cleaned in Ten Seconds without Soiling the Hands.

The Smith Premier Typewriter Co., Syracuse, N. Y., U. S. A.

We have 20 branch offices in the principal cities throughout the United States.

Send for Catalogue.

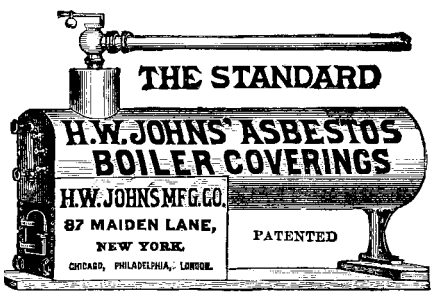
No one ever wrote **1000 Letters** an Hour,
that is, unless they first wrote one and then copied the rest on an

EDISON MIMEOGRAPH

Invented by Thos. A. Edison. For Daily Office Use in duplicating both handwriting and typewriting Anybody can operate it. Simple—Compact—Cleanly—Cheap. **Endorsed by over 90,000 users.** Catalogues and Samples of work sent free upon application. Manufactured only by the **A. B. DICK CO., 154 E. Lake St. Chicago.** Branch Offices, 47 Nassau St., N. Y. City, 117 So. Fifth St., Phila.

THE WILMOT & HOBBS MFG. COMPANY
ESPECIALLY SOLICIT ORDERS FOR SOFT AND EXTRA SOFT PLAIN BLUE FINISH OR ANNEALED OR PICKLED
HOT ROLLED BAND, STRIP AND PLATE STEEL
GREAT ACCURACY OF GAUGE WIDTH AND UNIFORMITY OF QUALITY WILL ALWAYS BE MAINTAINED
ALSO THE CELEBRATED BRIGHT SURFACE AND ANNEALED
COLD ROLLED SHEET AND STRIP STEEL
FOR DIFFICULT PRESSED, STAMPED, DRAWN WORK, &c.

UNEXCELLED BECAUSE OF ITS SMOOTHNESS OF SURFACE, ACCURACY OF GAUGE, GREAT DUCTILITY & STRENGTH, GENERAL UNIFORMITY AND FREEDOM FROM GRIT
FURNISHED IN ANY WIDTH FROM 1/2 TO 12 INCHES AND THICKNESS FROM 3 INCHES TO 300 FEET. ALSO ANY DEGREE OF TEMPER AND QUALITY OF SURFACE.
LARGE CONTRACTS SOLICITED FOR AUTOMATIC, HEAVY & DIFFICULT SHEET METAL BLANKED, STAMPED & DRAWN WORK, TUBES &c. NICKEL & BRASS PLATING, TINNING, JAPANNING & DIE MAKING. BRIDGEPORT, CONN.



AGENTS WANTED FOR **FINE TOOLS** IN EVERY SHOP.
WRITE FOR CATALOGUE AND AGENCY.
C.H. BESLY & CO.
CHICAGO, ILL. U.S.A.

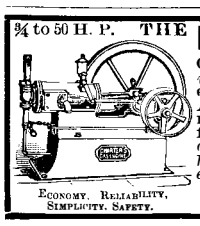
At 1/4 Price Gold and Silver Watches, Bicycles, Tricycles, Guns and Pistols, Carts, Buggies, Wagons, Carriages Safes, Sleighs, Harness, Cart Tops, Skids,

Sewing Machines,	Accordeons,	Organs,	Pianos,	Cider Mills,
Cash Drawers,	Feed Mills,	Stoves,	Kettles,	Bone Mills,
Letter Presses,	Jack Screws,	Trucks,	Anvils,	HayCutters,
Press Stands,	Copy Books,	Vises,	Drills,	Road Plows,
Lawn Mowers,	Coffee Mills,	Lathes,	Benders,	DumpCarts,
Corn Shellers,	Hand Carts,	Forges.	Scrapers,	Wire Fence,
Fanning Mills,	Wringers,	Engines,	Saws,	Steel Sinks,
Grain Dumps,	Crow Bars,	Boilers,	Tools,	Bit Braces,

Hay, Stock, Elevator, Railroad, Platform and Counter SCALES.
Send for free Catalogue and see how to save Money.
151 So. Jefferson St., CHICAGO SCALE CO., Chicago, Ill.

PATENT JACKET KETTLES

Plain or Porcelain Lined.
Tested to 100 lb. pressure. Send for Lists.
BARROWS-SAVERY CO.,
S. Front & Reed Streets, Philadelphia, Pa.



¾ to 50 H. P. THE **Motor of 19th Century**

Can be used *any place*, to do *any work*, and by *any one*. No Boiler! No Fire! No Steam! No Ashes! No Gauges! No Engineer! A perfectly safe Motor for all places and purposes. *Cost of operation about one cent an hour to each indicated horse power.* For circulars, etc., address

ECONOMY. RELIABILITY. SIMPLICITY. SAFETY.

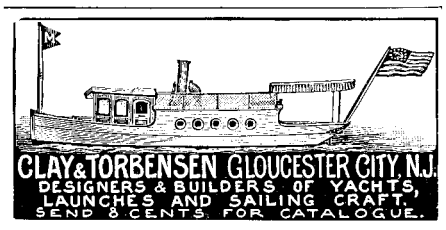
CHARTER GAS ENGINE CO.
P. O. Box 148. Sterling, Ill.

---

8 FT. $25
12 FT. $50
16 FT. $100
AERMOTORS
ALL STEEL
GALVANIZED
PUMPING OR GEARED SAME PRICE.

For the benefit of the public, the Aermotor Company declares a dividend and makes the above prices as a means of distributing it. These prices will be continued only until its surplus earnings are sufficiently worked off. Merit has prospered, and a very small profit on a very great number of outfits has given the Aermotor Company 4 acres of land in the best manufacturing center of Chicago, with many, very many, acres of floor space and the best equipment of machinery, for the purpose, in existence. The Aermotor Co. feels, in this crowning Columbian year, that it can afford to be generous. We will ship from Chicago to any one anywhere at the above prices.

THE AERMOTOR COMPANY,
12th and Rockwell Sts., CHICAGO.



The American Bell Telephone Company

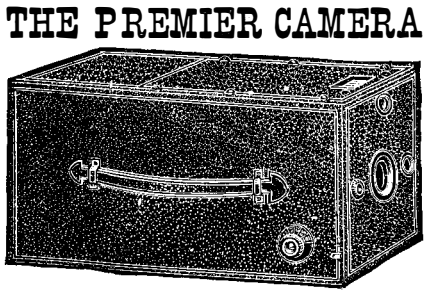
125 MILK ST., BOSTON, MASS.

This Company owns the Letters Patent No. 186,787, granted to Alexander Graham Bell, January 30, 1877, the scope of which has been defined by the Supreme Court of the United States in the following terms:

"The patent itself is for the mechanical structure of an electric telephone to be used to produce the electrical action on which the first patent rests. The third claim is for the use in such instruments of a diaphragm, made of a plate of iron or steel, or other material capable of inductive action; the fifth, of a permanent magnet constructed as described, with a coil upon the end or ends nearest the plate; the sixth, of a sounding box as described; the seventh, of a speaking or hearing tube as described for conveying the sounds; and the eighth, of a permanent magnet and plate combined. The claim is not for these several things in and of themselves, but for an electric telephone in the construction of which these things or any of them are used."

This Company also owns Letters Patent No. 463,569, granted to Emile Berliner, November 17, 1891, for a Combined Telegraph and Telephone; and controls Letters Patent No. 474,231, granted to Thomas A. Edison, May 3, 1892, for a Speaking Telegraph, which cover fundamental inventions and embrace all forms of microphone transmitters and of carbon telephones.

THE PREMIER CAMERA



IS THE BEST IN MARKET.
Simple of Manipulation.
Plates or Films are used.
The Shutter is always set.

PRICE $18.00.

Send for Catalogue and copy of Modern Photography.

WE MAKE ALL KINDS OF CAMERAS.

ROCHESTER OPTICAL COMPANY,
14 S. Water St., ROCHESTER, N. Y.

ELECTRICAL ✳ MINING ✳ MACHINERY

Electric Mine Locomotives, Electric Drills, Electric Coal Cutters, Electric Pumps, Electric Hoists.

WE ARE THE ONLY HOUSE IN THIS COUNTRY FURNISHING ELECTRICAL MINING MACHINERY

GENERAL ELECTRIC COMPANY,
DISTRICT OFFICES:

44 Broad Street.....New York.	620 Atlantic Avenue.....Boston, Mass.
173 and 175 Adams Street.....Chicago, Ill.	509 Arch Street.....Philadelphia, Pa.
Fifth and Race Streets.....Cincinnati, O.	401-407 Sibley Street.....St. Paul, Minn.
Equitable Building.....Atlanta, Ga.	1333 F Street, N.W.....Washington, D. C.
15 First Street.....San Francisco, Cal.	Masonic Temple.....Denver, Colo.

All business outside the U. S. transacted by Thomson-Houston International Electric Co. 44 Broad St. New York

---

PRINTING INKS.

The SCIENTIFIC AMERICAN is printed with CHAS. ENEU JOHNSON & CO.'S INK, Tenth and Lombard Sts., Philadelphia, and 47 Rose St., opp. Duane, New York

© 1893 SCIENTIFIC AMERICAN, INC.